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(71)Applicant : HITACHI LTD

(72)Inventor : SUZUKI HIDEAKI
MATSUZAKI YOSHIE
MAKITA HIROSHI
KISHIKAWA ROBERUTO
OKAMOTO KEIICHI
ONARI TAKASHI
OHASHI TOSHIJIRO
KITAZAWA HIROSHI
IZUSHI MINETOSHI
HAYAKAWA MITSUHARU

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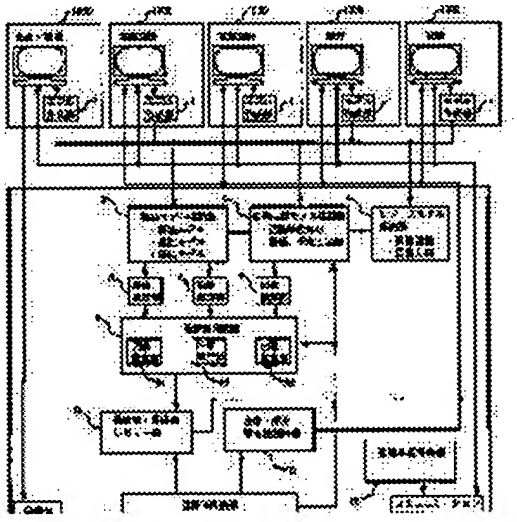
(54) DEVELOPMENT SUPPORT SYSTEM

(57)Abstract:

PURPOSE: To objectively monitor the progress state of development without placing any burden on a developing person by informing a user that respective progress estimated values do not satisfy corresponding target values when respective models are altered and detailed and the respective progress estimated values do not satisfy the corresponding target values.

CONSTITUTION: Estimated values which are estimated by a cost estimation part 5, a performance estimation part 6, and a day's schedule estimation part 7 are stored



in an estimated value storage part 8. Further, target values of the cost, performance, and day's schedule are stored in a target value storage part 12. The target values stored in the target value storage parts 12 are changed and detailed as the development advances. Then an estimated value and target value review part 9 checks the differences between the estimated values and target values, and informs the developing members of the differences through client machines 1000 or enables them to refer to the differences. Further, a total and partial consistency maintaining part 10 checks the consistency, and informs the developing members through the client machines 1000 that the consistency is lost, thereby preventing the target values from being altered so that the consistency is lost.

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CLAIMS

[Claim(s)]
[Claim 1] The resource model which is the system which supports development of a product and stores the model of a product, and the model of the resource used for a product development, A means to store a means to store the model of an activity of a product development, the desired value of the development schedule of a product, the cost price, and the whole engine performance, and the desired value of each part, A means to presume a development schedule, the cost price, and the advance predicted value of the engine performance from said each model, A means to support reference of said each model and each desired value by the development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and modification of each model, The development support system which has a means to notify a user of that in judging whether said each advance predicted value satisfies desired value when circumstantiation is performed, and not being satisfied at least.
[Claim 2] The resource model which is the system which supports development of a product and stores the model of a product, and the model of the resource used for a product development, A means to store a means to store the model of an activity of a product development, the desired value of the development schedule of a product, the cost price, and the whole engine performance, and the desired value of each part, A means to presume a development schedule, the cost price, and the advance predicted value of the engine performance from said each model, A means to support reference of said each model and each desired value by the development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and a means to support modification of said each desired value by the development person in charge, and circumstantiation, The development support system which evaluates the adjustment of whole desired value and partial desired value when modification of desired value and circumstantiation are performed, and has a means to notify a user of that when it is mismatching at least.
[Claim 3] The development support system which evaluates the adjustment of whole desired value and partial desired value when modification of said each desired value by the development person in charge, modification of the means and desired value which support circumstantiation, and circumstantiation are performed in a development support system according to claim 1, and is characterized by having further a means to notify a user of that when it is mismatching at least.
[Claim 4] A means to support modification of said each desired value and circumstantiation in a development support system according to claim 1, 2, or 3 is a development support system which consists of a means to support deliberations through two or more development persons' in charge development support system, and a means to perform modification of desired value and circumstantiation according to the result of the deliberations concerned.
[Claim 5] In a development support system according to claim 1 or 2 said development activity model For every development activity unit, the name of the development activity unit concerned, the constraint of the development activity unit concerned, The resource model concerned used per development activities, the product model concerned referred to per development activities, It is the model which

described the predetermined value and track record value of initiation of the product model in which the result of a development activity unit is shown, and an activity, and a termination stage and which expressed two or more activity unit information in the graph which shows the precedence relation of an activity unit.

[Claim 6] The development support system which describes the code which identifies the person in charge in charge in a development support system according to claim 5 for every activity unit which constitutes said development activity model.

[Claim 7] The development support system which describes the code which identifies the person in charge who set the contents as each item of a product model and a resource model in a development support system according to claim 1 or 2.

[Claim 8] The status-control item storing section which registers the status-control item used as the index of development progress of a product in the development support system according to claim 1 or 2, The status-control information monitoring section which extracts the information about a status-control item that two or more persons in charge concerning development of a product become the index of development progress of said product from the inside of the electronic information transmitted through an information network at the time of development, The development support system which has the status-control information storing section which stores said extracted information as status-control information, and the status-control information-reference section which enables reference of said status-control information stored at a user according to a demand of a user.

[Claim 9] It is the development support system which said electronic information is an electronic mail transmitted and received about each of two or more processings produced in connection with the business concerning development of said product in a development support system according to claim 8, and said status-control information monitoring section extracts the information about each of said status-control item included in said electronic mail, and is stored in said status-control information storing section as said status-control information.

[Claim 10] In a development support system according to claim 9, the processing performed using said electronic mail The estimated request about each part article which constitutes said product, the reply to the estimated request, The delivery report to order arrangements directions and its order arrangements directions, prototype manufacture directions, It is at least one processing. and the delivery report of the directed prototype and ** -- said status-control item storing section The completion time of the processing concerned which is one of the items corresponding to the processing performed using said electronic mail is stored as said status-control item. Said status-control information monitoring section The development support system which extracts the completion time of the processing performed using said electronic mail from said electronic mail, and stores it in said status-control information storing section as said status-control information.

[Claim 11] It is the development support system which has a display means to display said one or more status-control item in said status-control item corresponding to said status-control information for which said status-control information-reference section is stored in said status-control information storing section in the development support system according to claim 8 using the mark to which it is beforehand set corresponding to said the status-control item.

[Claim 12] It is the development support system which displays said status-control item corresponding to said one status-control information stored at the time newest stage of said status-control information from which said display means constitutes said product in a development support system according to claim 11, and which is stored in said status-control information storing section for every components using the mark to which it is beforehand set corresponding to said the status-control item.

[Claim 13] The inside of said status-control item stored in said status-control item storing section in the development support system according to claim 8, It has further the status-control information setting section which sets up the completion schedule time of the processing corresponding to each of said at least one or more status-control items. Said status-control information-reference section The inside of said status-control item corresponding to said status-control information stored in said status-control information storing section, the completion time which is said said set-up completion schedule time and

said status-control information about said status-control item to which said completion schedule time was set, and ** -- the development support system which has a display means to display inner one side or inner both.

[Claim 14] The inside of said status-control item stored in said status-control item storing section in the development support system according to claim 8, It has further the status-control information setting section which sets up the completion schedule time of the processing corresponding to each of said at least one or more status-control items. Said status-control information-reference section The inside of said status-control item corresponding to said status-control information stored in said status-control information storing section, About said status-control item to which said completion schedule time was set, said completion time said status-control item which is behind said set-up completion schedule time The development support system which has the display means which said completion time displays in distinction from said status-control item which is not behind said set-up completion schedule time.

[Claim 15] a development support system according to claim 8 -- setting -- said status-control item storing section -- the result of the count directions of a functional property about said whole product or its component part, and its directed count -- a report, experiment directions of a functional property, and the result of the directed experiment -- a report and ** -- the development support system which stores the item about at least one processing defined beforehand as said management item.

[Claim 16] The model of an activity of the contents of electronic communication of two or more persons in charge who start development of a product in a development support system according to claim 1 or 2 to a product development, In order to carry out monitoring of the desired value of the cost price of a product, the engine performance, and a development schedule automatically, The status-control item storing section which establishes two or more items corresponding to each of two or more of said computations, and stores one or more of items of it as a management item concerning development of said product, The computation directions to said computer defined beforehand about each of two or more of said computations, And the status-control information monitoring section which extracts the information about said management item from the information included at least in one side of the processing result outputs from said computer defined beforehand, The development support system which has the status-control information storing section which stores said extracted information, and the status-control information-reference section for referring to said information stored.

[Claim 17] In the development support system which supports the development which carries out sequential completion of two or more processings which two or more persons in charge concerning development of a product produce in connection with the business concerning development of said product while transmitting and receiving electronic information mutually Two or more information processors of two or more of said persons in charge which transmit and receive said electronic information, respectively, The information network equipment which connects with each of two or more of said information processors, and enables the exchange of said electronic information mutually about said two or more information processors, Connect with said information network equipment and said electronic information flow transmitted from said two or more information processors is controlled. Said information network is minded to said information processor of the receiver's address specified for said every electronic information. It has said electronic information distribution equipment which sends said transmitted electronic information, and the development progress monitoring system in which the development progress situation of said product carries out monitoring. The status-control information monitoring section which extracts the information about the status-control item defined beforehand that said development progress monitoring system is contained in said electronic information, The development support system which has the status-control information storing section which stores said extracted information, and the status-control information-reference section for referring to said information stored.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the development support system which offers two or more development persons' in charge coordination work environment especially about the development support system which is used at a company, works, etc. and which supports development of a new product.
[0002]
[Description of the Prior Art] Conventionally, as a system which supports the coordination activity by two or more users, the system given in JP,3-250365,A is known, for example.
[0003] According to this system, a meeting can be held from the location which two or more persons left in the phase phase of the business currently performed as a group using two or more information processors, for example, the situation of each activity which each has done separately can be grasped, and it can return to each activity based on this result.
[0004] Moreover, as a system which manages the other conventional development, the system given in JP,4-364529,A is known, for example. This conventional technique performs development management of software in development of the software by two or more developers by exchanging the electronic mail which prepares the contents concerning each module development, i.e., an instruction code item, a project name item, an activity code item, an activity data item, a requesting agency item, a trustee item, a period item, and a priority item in the wording of a telegram (electronic mail) used for the communication link between developers, and contains such development management information in it.
[0005] Without according to such a system, being influenced by a communication partner's convenience since an electronic mail is used, the matter concerning development can be notified and development management without the need of preparing printed matter, such as a document, further can be performed.
[0006]
[Problem(s) to be Solved by the Invention] By the way, the development project which develops a certain new product is each phase of a project, and it is necessary to carry it out, adjusting the desired value of the whole development project, the advance predicted value of the whole development project, the desired value of project each activity, and the advance predicted value of project each activity mutually.
[0007] However, supported by the coordination activity by the mere information interchange in the 1st conventional support system mentioned above, the user itself has to manage such all adjustments.
[0008] For this reason, even if it uses such a conventional support system, the burden which a user has to pay to management of target achievement, such as engine performance of a development product, the cost price, and a schedule, etc. is fully unmitigable.
[0009] That is, in the conventional support system, it cannot be said that this **** desired value of the whole development project and a part and **** advance predicted value, and mutual adjustment management are fully supported.

[0010] When the exchange of the wording of a telegram for said development management is needed and there is no exchange of this wording of a telegram, it becomes impossible moreover, to completely perform development management in the 2nd conventional system mentioned above. Moreover, even if a developer does a different report from the actual condition of progress, it does not have the function which checks it.

[0011] Then, this invention sets it as the 1st purpose to offer the whole development project of a product development, the desired value of a part and an advance forecast, and the development support system that can support mutual adjustment management.

[0012] Moreover, even if especially this invention does not exchange the wording of a telegram for development management, a burden is not applied to a developer and it sets it as the 2nd purpose to offer the development progress monitoring means which can carry out monitoring of the progress situation objective.

[0013]

[Means for Solving the Problem] It is the system by which this invention supports development of the product by two or more development persons in charge for said 1st purpose achievement. The model of a product, A means to store the resource model which stores the model of the resource used for a product development, and the model of an activity of a product development, A means to store the desired value of the cost price of a product, the engine performance, and the whole development schedule, and the desired value of each part, A means to presume the advance predicted value of the cost price, the engine performance, and a development schedule from said each model, A means to support reference of said each model and each desired value by each development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and modification of each model, In judging whether said each advance predicted value satisfies desired value when circumstantiation is performed, and not being satisfied at least, it offers the development support system characterized by having a means to notify a user of that.

[0014] For said 1st purpose achievement, moreover, this invention It is the system which supports development of the product by two or more development persons in charge. The model of a product, A means to store the resource model which stores the model of the resource used for a product development, and the model of an activity of a product development, A means to store the desired value of the cost price of a product, the engine performance, and the whole development schedule, and the desired value of each part, A means to presume the advance predicted value of the cost price, the engine performance, and a development schedule from said each model, A means to support reference of said each model and each desired value by each development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and a means to support modification of said each desired value by the development person in charge, and circumstantiation, When modification of desired value and circumstantiation are performed, the adjustment of whole desired value and partial desired value is evaluated, and when it is mismatching at least, the development support system characterized by having a means to notify a user of that is offered.

[0015] Moreover, two or more persons in charge whom the 2nd purpose of the above requires for development of a product transmit and receive electronic information mutually. Development of said product which carries out sequential completion of two or more processings produced in connection with the business concerning development of said product It is the development progress monitoring means in the system to support which carries out monitoring of the development progress situation of said product. The status-control item storing section which establishes two or more items corresponding to each of the processing of said plurality performed by transmitting and receiving said electronic information, and stores one or more of items of it as a status-control item used as the index of development progress of said product, The status-control information monitoring section which is contained in said electronic information and which extracts the information about said status-control item, It is attained by the development progress monitoring means characterized by having the status-

control information storing section which stores said extracted information as status-control information, and the status-control information-reference section for referring to said status-control information stored.

[0016]

[Function] In according to the development support system concerning this invention judging whether said each advance predicted value satisfies desired value when modification of each model and circumstantiation are performed, and not being satisfied at least, it notifies a user of that.

[0017] Moreover, when modification of desired value and circumstantiation are performed, the adjustment of whole desired value and partial desired value is evaluated, and when it is mismatching at least, a user is notified of that. Therefore, each person in charge person of a product development can form the optimal plan for target achievement, checking the adjustment of the whole obtained from a design result objective while detailing with development planning for which the detail has not opted in the beginning of development to progress of development and the advance predicted value of each activity, and desired value, and the adjustment of the desired value of the whole activity, and the desired value of each activity.

[0018] Furthermore, in the development progress monitoring means by this invention, out of the information which the person in charge concerning the above development transmits and receives, monitoring of the information about said status-control item which is the information concerning development progress automatically is carried out, and the information is stored in the status-control information storing section. The progress situation of development can be grasped because each development person in charge or a development status-control person refers to this status-control information stored.

[0019] Thus, since especially the information about a status-control item is not acquired by exchanging the wording of a telegram for development management, it does not necessarily require a man day special for development management. Moreover, without differing from the actual condition of progress, since monitoring of this information is carried out to development from the electronic mail concerning indispensable operating processing, a man day cannot newly be applied but ** can also carry out monitoring of the progress situation objective.

[0020]

[Example] Hereafter, one example of the development support system concerning this invention is explained.

[0021] In this example, development members, such as a development manager, a machine design person, an electrical-design person, a prototype manufacturer, and a prototype-test person, are assumed as a user of a development support system.

[0022] The configuration of the development support system applied to drawing 1 at this example is shown.

[0023] The client machine with which each development member uses 1000, respectively, and 2000 are server machines which process according to the demand of each client machine 1000 among drawing.

[0024] Each client machine 1000 is equipped with the model creation section 1 which it uses in case a development member creates a product model, a development activity model, and a resource model, and the created model is stored in the product model storing section of 2 of a server machine 2000, the development activity model storing section of 3, and the resource model storing section of 4, respectively.

[0025] In addition, the structure of a product, an attribute, a property, etc. are described by the product model. Moreover, the precedence relation between activity units, a schedule, a track record of an activity, etc. are described by the development activity model for every activity unit which divided the activity of the whole development into the partial activity. And the capacity of a facility and the information on a development pursuer which development, such as a manufacturing facility, a test facility, etc. of a prototype, takes are described by the resource model. The development activity model links the product model and resource model about the activity, as shown in drawing 2 .

[0026] Next, the cost presumption section which presumes the cost price from the product model with

which the development activity model linked five in a server machine 2000, the engine-performance presumption section which presumes the engine performance from the product model with which the development activity model linked 6, and 7 are the schedule presumption sections which presume a development schedule from development rating and a resource for every unit of a development activity model, and the estimate which these presumed is stored in the estimate storing section of 8. In addition, each estimate is respectively stored in the cost estimate storing section 81, the engine-performance estimate storing section 82, and the schedule estimate storing section 83.

[0027] Moreover, the desired value of the cost price, the engine performance, and a schedule is stored in the desired value storing section of 12. This desired value is determined in the time of development, using the desired value assignment section of 13 as a result of a plan and a design, and is stored in the desired value storing section 12.

[0028] The desired value stored in the desired value storing section 12 is changed with advance of development, or is detailed. Although this modification and circumstantiation are performed by deliberations and decision of each development member, the communication Management Department of 11 manages modification and circumstantiation of these deliberations and decision, and the desired value based on this.

[0029] Although the cost price and the engine performance which it was previously described as this desired value, and the estimate of a schedule are not necessarily in agreement, development activities must be managed so that it may be in agreement with desired value.

[0030] In order to realize such management, estimate and the desired value review section 9 check the difference between estimate and desired value, and a development member can be told or it enables it to refer to this through a client machine 1000. Moreover, desired value has the partial desired value of various level, and these partial values and the whole value must take adjustment. The whole and the partial adjustment maintenance section 10 check this adjustment, when adjustment collapses, it tells a development member about it through a client machine 1000, and it is made not to change desired value which breaks down adjustment.

[0031] Next, the example of a configuration of the development activity model stored in drawing 2 at the development activity model storing section 3 is shown.

[0032] As shown in drawing 2 , the development activity model stored in the development activity model storing section 3 expresses the precedence relation as an activity unit in a graph.

[0033] Moreover, in each activity unit, a predetermined value, a track record value, etc. of initiation of a development activity name, the responsibility person in charge of development activities, the constraint of development activities, the resource model used for development activities, the product model referred to at the time of development activities, the product model in which the result of development activities is shown, and an activity, and a termination stage are described, for example so that it may illustrate.

[0034] Thus, although the schedule and track record of development activities are shown to a development activity model by the unit of development activities, this schedule is detailed with advance of development, and also produces modification. This is inevitably generated from it being the activity in which a product development contains many indefinite elements. Then, when the contents of the development activity model are changed, this development support system presumes the effect to the schedule, the cost price, and the engine performance, as shown in the following examples, and connects relation with desired value to each development member.

[0035] Thereby, the grasp evaluation of the effect of modification of a development activity model can be carried out easily, it can form the plan to the completion of development which satisfies each desired value based on each prospect in a time, and can describe each development member to a development activity model.

[0036] Hereafter, managing about each of the cost price, the engine performance, and a schedule, so that such desired value and estimate may have consistency, the case where each development member furthers development in cooperation is taken for an example, and actuation of the development support system concerning this example is explained.

[0037] First, the actuation in the case of furthering development is explained, managing a development schedule.
[0038] First, the schedule assignment section 320 in the desired value assignment section 13 sets the schedule target at the time of development initiation as the desired value storing section. As for this desired value setup, plan / design charge of a new product sets the sale stage of a new product. And the schedule assignment section 320 inputs data, such as the conventional development track record, and performs a schedule assignment for every unit of development activities required to refer to this and realize the set development stage.
[0039] Then, it is 601 which presumes rating also about non-started development activities during a design, and is set up to a development activity model in an activity plan while design persons in charge, such as machine electrical and electric equipment, design their part in their duty shown with a development activity model and storing a design result in the product model storing section 2 as shown in drawing 6 for example.
[0040] Moreover, 602 [store / to the resource model storing section 4 / resource data rating is presumed concerning non-started development activities during an activity in storing the activity result of each part in its duty not only a design person in charge but the person in charge of a prototype and a trial is indicated to be with a development activity model to the product model storing section 2 ****, and an activity plan can be set as a development activity model, or it can be used to development, such as a facility and a staff,].
[0041] It is 604 which presumes subsequent development schedules and stores schedule estimate in the estimate storing section 8 using the development facility which the schedule presumption section 7 grasps the development advance situation and the remaining development rating at that time from this development activity model, and is stored in 603 and the resource model storing section 4, or a staff's data.
[0042] Here, the count method of the schedule presumption section 7 is explained using drawing 8 . Drawing 8 is a flow chart showing the computational procedure of the schedule presumption section 7. 801 which acquires the schedule data of the present condition of an object project from the development activity model storing section 3 first in the schedule presumption section 7. Next, 802 which acquires the information about a resource from the resource model storing section 4. Next, although count of whenever [progress] is performed, in 804 and this invention, the remaining man days are presumed using the definition of whenever [progress / as shown in drawing 9]. Two indexes shown in drawing 9 are 805 which is what presumes the remaining man days by the statistical analysis of the termination situation of an operation item. An index 1 is an index which presumes the remaining man days to be the operation items ended by the presumed point in time from the man day which it took, and an index 2 is an index which presumes the remaining man days from the problem solved by the presumed point in time, and the man day which it took. The problem is a problem which checks advance of a project, for example, are the various troubles generated in the experimental model in the trial process of the experimental model in the development process of a new product here. In addition, an index 1 can carry out schedule presumption in a project at large by processing which avoids this, although there is [a denominator] the singular point of 0 at the time of initiation of a project, and an index 2 also has the singular point when the number of solution problems is 0.
[0043] Estimate and the desired value review section 9 compare schedule estimate with the schedule desired value corresponding to it, and a development member enables it to refer to 605 and its information.
[0044] Thus, it is 606 which estimate and the desired value review section 9 tell this information to a development member when it becomes clear that an activity progresses and schedule estimate cannot attain schedule desired value, and requires a cure.
[0045] Drawing 10 is a flow chart showing the procedure of the above-mentioned processing of estimate and the desired value review section 9. Estimate and the desired value review section 9 are 1001 which acquires termination estimate from the schedule estimate storing section 83 first. Next, 1002 which acquires termination desired value from the schedule desired value storing section 123. Next, 1005

which generates the message of warning when it is over the threshold as which these differences were calculated and the value of 1003 and delay was determined beforehand. The receiver's address data of a message are also added to this warning message. Thus, according to estimate and the desired value review section, it is in the middle of advance of a project, and the visualization of the plan is carried out immediately and the early cure of it is attained one day [in question].

[0046] There are modification of the sequence of the development activities which serve as a neck as a cure after target attaining, enhancement of a development resource, etc. Since other development activities are influenced in any case, the deliberations 607 of a development member are needed. The communication Management Department 11 is 608 which changes the desired value of the desired value storing section 12, or changes a resource model and a development activity model based on the discussed contents. From the changed development activity model, the schedule presumption section 7 re-presumes subsequent development schedules, and stores schedule estimate in the estimate storing section 8.

[0047] The whole and the partial adjustment maintenance section 10 evaluate the contents which were discussed and judged and were reflected in the desired value storing section 12 on the other hand. And since the information is told to a development member when there is mismatching of estimate, desired value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.

[0048] The example shown above is explained to a detail using the example of a screen. Drawing 11 is drawing showing the example of 1 screen for specifying the schedule of the activity item (activity unit) in a development activity model. Here, a design is completed and the performance test phase for checking achievement of the target engine performance to an experimental model is explained to an example. In the case of this example, an activity item (activity unit) serves as a thing of an engine-performance verification-test item. Here, since the case where a trial section performs the schedule control of a performance test is made into the example, in the window 1100 which displays the carbon button group which expresses a user first as shown in drawing 11 , the carbon button corresponding to a trial section is chosen, and it goes into a scheduling screen.

[0049] all the operation item displays 1103 that a scheduling screen carries out in this project with the project name display 1101 for a plan, and the project termination schedule display 1102, the resource display 1104 for performing this operation item, the standard duration display 1105 of this operation item, and the schedule display 1106 that displays a schedule by the die length based on a standard duration -- ** -- since -- it is constituted. For example, supposing today's date is September 2, display Rhine 1107 will be displayed on the part of an applicable date on the day. As mentioned above, the die length of the schedule bar 1108 turns into die length corresponding to the standard duration displayed on the standard duration display 1105. A project name is inputted by the keyboard in the model creation section 1 of a client machine 1000. The inputted project name is stored in the development activity model storing section 3. The project termination scheduled day currently displayed on the project termination schedule display 1102 shows the end date stored in the development activity model storing section 3, and setting modification is possible for it at the desired value setup key 1102. Processing of a desired value setup key is a carbon button for processing a desired value setup of the communication Management Department 11. The project termination presumption day currently displayed on the project termination schedule display 1102 is a schedule stored in the estimate storing section 8, and this is the value which the schedule presumption section 7 calculated as it was explained using drawing 8 . When a presumed termination schedule is compared with this project termination desired value, a system blinks the carbon button of the "trial section" which is a schedule-control person in the window 1100 which displays the carbon button group showing a user as warning.

[0050] Next, the operation situation input carbon button 1109 is explained. After one operation item is completed, whether the item was completed needs to be checked of such a trial process. It is because it can say that the design of a product was ended only after clearing all the operation trial items. Then, the means for inputting situations, such as "success", a "rejection", and "a hold", to each item is this operation situation input carbon button 1109.

[0051] Next, copy/migration carbon button 1110 is explained. Between operation items, precedence relation is defined beforehand. This is specified in the model creation section 1 of a client machine 1000 at the time of early planning, and expresses the restricted relation to activation of the item "Item B cannot be performed unless Item A is passing." The copy of the item which had such precedence relation, and interlocking migration are explained using drawing 12 . Here, suppose that precedence relation is beforehand defined between Item B and Item C. That is, Item C can be performed until Item B is "passing." First, "a copy" is explained. Since Item B was not passing, (a) of drawing 12 shows the situation of performing Item B again two days after. It is realizable with the actuation in this system by copying the trial item which corresponds using a copy carbon button. By this copy, all item attributes other than an item enforcing date are copied. If it specifies that it performs Item B two days after after copying, as shown in [in the right figure of drawing 12 (a)], Item C will interlock and will move following Item B. At this time, the schedule which opened is packed automatically and the schedule after it shifts automatically back. Next, "migration" is explained. (b) of drawing 12 expresses the case where Item B is shifted compulsorily two days after, when Item B is not able to be performed by a certain cause on the first plan day. In this case, if Item B is shifted two days after, Item D and Item E which the item C which had precedence relation carried out interlocking migration automatically, and were in the schedule which opened back will be packed automatically. The right figure of drawing 12 (b) shows this result. By having defined precedence relation between such items, the plan of the item which should be carried out is mistaken and it can draw up quickly [there is nothing and].

[0052] Next, an example of the adjustment of the desired value of the desired value storing section 12 based on the contents of deliberation between persons in charge by the communication Management Department 11 or the warning process of mismatching is explained using drawing 13 . When the trouble which checks advance while a project is going on occurs, the cure is implemented immediately and it must be made not to have to delay the schedule of a project. However, it is a design section that making the planning correction of the scheduling draws up a cure to being a trial section in the case of this example, a cure is put into activation and a prototype section adds correction to an experimental model. For this reason, when a problem occurs, in order for a trial section to plan a retest day, it is necessary to get to know the schedule of a design and a prototype section. It is used, also in order the communication Management Department 11 is such and also to promise a term as that the schedule of a section is got to know based on the schedule. Drawing 13 is drawing for explaining the scheduled input for it. Drawing 13 shows the screen which inputs the convention about an item 4. If an item 4 is chosen on the schedule display screen shown in drawing 11 , a window as shown in drawing will be displayed, and the trouble display column 1301 and the operation cure column 1302 to the trouble are displayed first. Then, a user inputs a convention schedule into the column of the section to which he corresponds, respectively. If an example is given, the design-change schedule column 1303, the design-change termination column 1304, and the column 1305 wishing reconstruction will be inputted in a design section, and will input the reconstruction convention column 1306, the reconstruction implementation column 1307, and the column 1308 wishing test in a prototype section. The trial section which draws up a trial schedule can carry out the re-schedule of the trial schedule with reference to the convention term on this window. According to this system, even if a person in charge is absent by telephone etc. at the time of an inquiry, the data which the person in charge inputted can be referred to. Even if it passed over the date entered in the design-change schedule column 1303, when the date was not inputted into the design-change termination column 1304, as it was monitoring continuously the value of the design-change schedule column 1303 into which a design section inputs a system here, and the design-change termination column 1304, and it judges that it has passed over a term, a system generates warning and it explained above, the carbon button of the corresponding design section becomes red, and it blinks. Moreover, when delay is in a term also like the reconstruction convention column 1306 and the reconstruction implementation column 1307 of a prototype section, actuation which generates warning is carried out. Thus, when a system carries out term management automatically and generates warning, it is effective in the ability to make delay of schedule progress into minimum.

[0053] Although the function and use gestalt of this invention in the case of furthering development

were shown managing a schedule above next, the case where development is furthered is explained managing the cost price.

[0054] First, plan / design charge of a new product defines the target cost of a new product from commercial-scene information etc. As shown in drawing 3 , the desired-value assignment section 13 has the cost allotment section 300 which assigns cost desired value to each unit which is the configuration unit of a product, the engine-performance allotment section 310 which performs allotment of the engine performance, and the schedule allotment section 320 which performs allotment of a schedule, and the cost assignment section 300 assigns this target cost to each unit which constitutes a product, and it sets the cost desired value of each unit as the desired-value storing section 12.

[0055] As shown in drawing 3 , the cost assignment section 300 is equipped with allocation-of-cost 302 module which performs the allocation of cost for every unit using the function of the cost-analysis module 301 which inputs the existing reference model information 330 and analyzes the cost structure according to unit of a reference model, and the cost structure according to process, the cost simulation module 303 which inputs the cost reference-value information 340, such as production quantity and a raw-material labor cost, and carries out simulation of the relation of the cost of product to these, and a cost-analysis module and a cost simulation module.

[0056] In addition, it is desirable for the desired value assignment section 13 to be made to carry out a cost assignment, automatic not performing a cost assignment altogether but receiving the interactive directions from plan / design person in charge suitably. Now, since a cost assignment here is the time of development, it is not assigned to components each and assigned the block of the components which constitute a product, and according to main units. Next, as shown in drawing 4 , the development member details the design.

[0057] For example, design persons in charge, such as machine electrical and electric equipment, are 400 which designs its part in its duty shown with a development activity model, and is stored in the product model storing section 2 by using a design result as a structure model and an attribute model.

[0058] It is 402 which the cost presumption section 5 presumes the cost price from this model, and stores 401 and cost estimate in the estimate storing section 8. Estimate and the desired value review section 9 compare this cost estimate with corresponding cost desired value, and each development member enables it to refer to that information result suitably if needed.

[0059] Now, the part by which cost presumption was carried out, and the unit to which cost desired value is set do not correspond at this time. When the part by which cost presumption was carried out is a part of unit to which cost desired value is set, estimate and the desired value review section 9 Cost desired value is divided into the part by which cost presumption was carried out, and the part by which cost presumption is not carried out, and the value which lengthened the value by which cost presumption was carried out from the cost desired value of the whole unit is stored as a target cost of the remaining part.

[0060] Now, when the cost estimate of each unit to which it carried out in this way, the design progressed to, and cost desired value was set can be found and the cost estimate which was able to be found exceeds cost desired value, estimate and the desired value review section 9 are 405 which tells this information to a development member and requires a cure.

[0061] As a cure, the design of the part having exceeded cost desired value is changed, and there are an approach of making a presumed cost low and the approach of raising the target cost of this part according to cost estimate.

[0062] When based on the latter approach, the sum total of the whole cost target and the cost target of a part stops however, being in agreement. Then, the whole and the partial adjustment maintenance section 10 detect this, tells this information to a development member, and requires a cure.

[0063] In addition, there are an approach of lowering the cost desired value of other parts and attaining the whole cost desired value as this cure, and a method of changing the whole cost desired value. This decision is based on the deliberations 407 of each development member, or decision of a development person in charge. The communication Management Department 11 is 406 which grasps these discussed contents and sets that result as the desired value storing section 12.

[0064] Thus, the result discussed and judged is reflected in the desired value storing section 12, and the whole and the partial adjustment maintenance section 10 evaluate the reflected contents. And since the information is told to a development member when there is mismatching of estimate, desired value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.
[0065] Hereafter, furthering-development actuation is explained, managing the target engine performance.
[0066] The engine-performance assignment section 310 in the desired value assignment section 13 sets the performance-objective value at the time of development initiation as the desired value storing section first like [management of the engine performance] cost control. This desired value setup is performed, when plan / design charge of a new product assigns the property of the conventional reference model, and the product property that input the experimental result about a development model, refer to this, and it is related, from commercial-scene information etc. so that the engine-performance assignment section 310 may satisfy this target engine performance by defining the target engine performance of a new product.
[0067] For example, when an air-conditioner is considered as a product and cooling capacity and the noise are considered as engine performance, as a property related to cooling capacity, there is a property of the property and compressor of a heat exchanger, or a fan, and there are a fan's ventilation sound, an oscillating sound of a case, an operation sound of a motor, etc. as a property about the noise. In this case, the engine-performance assignment section inputs the experimental result about the conventional property of a reference model and a conventional development model, and defines the noise desired value allowed this by reference from the whole noise target at a ventilation sound, an oscillating sound, and an operation sound.
[0068] Next, using this performance-objective value, the development member details the design, as shown in drawing 5 .
[0069] That is, for example, design persons in charge, such as machine electrical and electric equipment, are 501 which designs its part in its duty shown with a development activity model, and is stored in the product model storing section 2 by using a design result as a property model. It is 503 which the engine-performance presumption section 5 presumes the engine performance from this model, and stores 502 and engine-performance estimate in the estimate storing section 8.
[0070] This engine-performance presumption is performed by approaches, such as the so-called simulation and presumption based on the test data of the experimental model presumed and developed from the conventional track record data. Since presumed precision differs greatly, it is made to store in engine-performance estimate here also including the presumed approach by the result of having manufactured and examined the experimental model with presumption from simulation or the conventional track record data.
[0071] Estimate and the desired value review section 9 compare engine-performance estimate with the performance-objective value corresponding to it, and a development member enables it to refer to 504 and its information.
[0072] Thus, it is 505 which estimate and the desired value review section 9 tell this information to a development member when it becomes clear that engine-performance estimate (the engine-performance achievement value by trial is included) cannot attain a performance-objective value, as a result of a design progressing, and requires a cure.
[0073] There are an approach of changing as a cure the design of the part which cannot attain a performance-objective value, and a method of dropping the target engine performance of this part according to engine-performance estimate. In the case of the latter, deliberations of a development member or decision of a development person in charge is needed. The communication Management Department 11 is 506 which grasps these discussed contents and sets that result as the desired value storing section 12.
[0074] Thus, the result discussed and judged is reflected in the desired value storing section 12, and the whole and the partial adjustment maintenance section 10 evaluate the reflected contents. And since the

information is told to a development member when there is mismatching of estimate, desired value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.

[0075] Next, the actuation which makes circumstantiation and modification of a development activity model with advance of development is explained.

[0076] The development activity model used as the model to which it is indicated that the outline stated previously at the beginning of development is detailed gradually.

[0077] The activity of this circumstantiation can be done as follows.

[0078] For example, in order the result of mechanical layout design is needed in order to carry out an electric packaging design, or to determine a detailed design parameter, when the result of the characteristic test about the design specification is needed, needing the result of other business often arises in the process in which each development member performs business of its part in its duty shown with a development activity model. If these activities are described as an activity unit in a development activity model, this development member does not understand it like the result of that activity, or a working day at development members other than the person in charge of that activity unit, when that activity is a part of activity unit described by the development activity model, although it can refer to like that activity result and working day.

[0079] In such a case, a development member is 701 which asks the person in charge of an activity who wants to know a detail, i.e., the person in charge of an activity unit including an activity, the result and schedule of an activity as shown in drawing 7 . Such a question is realizable by sending the electronic mail of the defined format 703 to the person in charge of a question place. The reply 702 to this question is similarly performed by the electronic mail. Since the code which identifies the person in charge in charge of the activity is prepared and each development member can refer to a development activity model per activity here as previously shown in drawing 2 , the reference about each activity unit can be recognized mutually, and it becomes possible to send an electronic mail which was described previously.

[0080] Now, the communication Management Department 11 is 704 which sets the new desired value which managed the contents of the question 701 and reply 702 by such electronic mail, and was not set up till then according to the contents of the reply as the desired value storing section 12, or sets a new development activity unit as 705 and the development activity model storing section 3.

[0081] As an example set up as new desired value, there are the detailed schedule items of an activity, the cost price, the desired value items of the engine performance, etc. it was decided that only the schedule of an outline would be, for example.

[0082] Moreover, the development activities for acquiring the desired value set up here will newly be described by the development activity model as one activity unit.

[0083] Thus, by carrying out the question and reply about the business he wants to know a development member mutually, a development activity model and desired value can be detailed and it can go.

[0084] In addition, the person in charge in charge of the activity unit which becomes origin makes the circumstantiation and modification of each activity unit in a development activity model. Modification of the person in charge in charge is possible. Moreover, the code which identifies the person in charge who set the contents as each item which constitutes a model also about a product model and a resource model is prepared, and reference and management of writing are performed to each person in charge person.

[0085] As explained above, while according to this example storing in the product model storing section the product model expressing the structure and the property of the product which each development person in charge takes charge of and which was designed for every part and presuming the engine performance and the cost price of a product from this product model, a schedule is presumed from the development rating and the development resource of each part, this partial advance predicted value is totaled and the advance predicted value to the whole product development is calculated. Each person in charge person can share the advance predicted value of the whole development which changes with progress of development by this. And the plan of development activities can be adjusted so that a target

can be attained for this whole and a partial advance predicted value as compared with desired value. Moreover, when a development person in charge corrects or details the target and schedule of an activity relevant to mutual automatically from the information on the communication which carries out a question and a reply mutually, the newest desired value can always be held and each person in charge person can be shown.

[0086] Therefore, detailing with development planning for which the detail has not opted in the beginning of development to progress of development, each person in charge person of a product development can maintain the adjustment of the whole advance predicted-value part obtained from a design result objective, and can form the optimal plan for target achievement.

[0087] Next, the communication Management Department 11 does monitoring of the information transmitted among persons in charge, and shows the processing which sets up automatically the track record information on the development activity model storing section 3, and the desired value of the desired value storing section 12.

[0088] The communication Management Department 11 of this example The status-control item storing section 1401 which stores the status-control item made into the index of the status control defined beforehand as shown in drawing 14 , The fixed form electronic mail collection section 1402 which collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development, The status-control information monitoring section 1403 which extracts the information about the above-mentioned status-control item included in the collected electronic mail, The status-control information storing section 1404 which stores the extracted information as status-control information, It has the status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section, and the I/O section (not shown) which displays a processing result while receiving the actuation from the outside.

[0089] There are a status-control item about structure about each part article which constitutes the product or it which it is going to develop as a status-control item used as the index of the progress memorized by the status-control item storing section 1401, and a status-control item about the function. As a status-control item about structure, the start date of a design drawing and a completion date, the request day of the estimate based on the drawing, and its return date are used, for example.

[0090] Moreover, as a status-control item about a function, a date of acquisition can be used as a result of the examination opening day of the engine performance to demand and a decision day, a prototype directions day and a date of payment, and the opening day of a functional experiment, for example. Here, the status-control item about a function shows the degree of the achievement about the functional characteristic which it is going to attain rather than shows progress of development directly.

[0091] With input units (un-illustrating), such as a keyboard, the status-control item memorized by the status-control item storing section 1401 receives the actuation from the outside, and has composition which can perform addition or deletion.

[0092] The status-control information storing section 1404 memorizes the status-control information (date etc.) which is the concrete contents of the information about each status-control item memorized by the status-control item storing section 1401.

[0093] With input units (un-illustrating), such as a keyboard, the status-control information-reference section 1405 receives the directions from the outside, and displays the status-control information memorized by the status-control information storing section 1404 through output units (un-illustrating), such as CRT, corresponding to the directions.

[0094] The communication Management Department 11 of this example can be realized by computer which specifically has the information processor equipped with CPU and memory, and an I/O device equipped with CRT and a keyboard.

[0095] the development tools 101, 102, and 103 of the person in charge of the section which the communication Management Department 11 of this example requires for development by the information networks 104, such as LAN (Local Area Network), -- it connects with ...

[0096] the person in charge start to each development -- development tools 101, 102, and 103 -- while performing business concerning development using the processing terminal of ..., for example, a CAD

(Computer Assisted Design) tool and operating information, operating communication like a required estimated request and reply communication, order arrangements directions, delivery communication and prototype manufacture directions, and manufacture track record communication in each one of business is carried out. Here, although the person in charge concerning development considers as the development person in charge who develops a product mainly, the person in charge of this invention may not be limited to this, for example, other persons in charge of the administration are satisfactory for him.

[0097] In this invention, it is considering as the configuration performed using the fixed-form-ized electronic mail about operating communication which includes the information about the above-mentioned status-control item among such operating communication. in addition -- an information network 104 -- not necessarily -- a development tool 101 ... does not need to be connected and you may be the configuration that the input/output terminal of the above-mentioned fixed form electronic mail is connected, instead of a development tool.

[0098] According to the configuration of the communication Management Department 11 of this example, the progress situation of development can be grasped by carrying out the monitor of the information about the status-control item which is included in the fixed form electronic mail and which was defined beforehand in the fixed form electronic mail collection section 1402 and the status-control information monitoring section 1403. Below, a more concrete example is given and explained.

[0099] In this example, the concrete example using the status-control information which is the information about the status-control item about the structure of a development product is explained using drawing 15 . Here, the product structure tree in which the configuration of a product is shown shall be used for the status-control information storing section 1404 as one gestalt which memorizes status-control information. The hierarchical relationship of the whole product, a module, and components is shown, and this product structure tree is usually the same structure as fundamentally as the data called a product structure tree.

[0100] The description of the product structure tree in this status-control information storing section 1404 As information on the node of a tree, as shown in drawing 15 , it adds to the usual design drawing data. The information (for example, processing time) which shows the progress about an estimated request, a reply and order arrangements directions, delivery and prototype manufacture directions, and processing like a manufacture track record as information about a status-control item It is in making it correspond to the column of the progress attribute established for every each part article prepared beforehand with each drawing, and storing in it.

[0101] The information about the above-mentioned status-control item is extracted from the fixed-form-ized electronic mail which is used in case each person in charge persons, such as a design, materials, and a manufacturing department, do operating communication about development, and is stored in the column of the progress attribute which shows the progress situation of the components which constitute a product structure tree.

[0102] For example, if the estimated request to the components which the design section person in charge designed is performed using the fixed form electronic mail 211 to the Supplies Department gate person in charge, the mails 211 will be collected by the fixed form electronic mail collection section 1402. A postscript is carried out about the concrete approach of collection of an electronic mail. The monitor of the information 203 on the collected electronic mail 211 is carried out by the status-control information monitoring section 1403, and it is stored in the column of the estimated request of components which the time of the date of issue of the mail 211 makes the object in the status-control information storing section 1404.

[0103] Moreover, when the Supplies Department gate person in charge who received this estimated request electronic mail 211 estimates and a reply is performed using the fixed form electronic mail 212, the monitor of that mail 212 is carried out by the status-control information monitoring section 1403, and the time of the date of issue contained in the information 204 on that estimated reply electronic mail 212 is stored in the column of the estimated reply of components made into the object in the status-control information storing section 1404.

[0104] Although the above shows an estimated request of the components of the product currently developed, and processing of registration of the time to the column of a reply The order arrangements directions day and the date of payment, prototype directions day, and manufacture completing date of a configuration member of each part article It is stored in the predetermined column of the status-control information storing section 1404 by carrying out the monitor of the above-mentioned information and the information 205, 206, 207, and 208 similarly included in each of the fixed-form-ized electronic mails 213, 214, 215, and 216, respectively.
[0105] Moreover, it is good also as a configuration which registers information like the estimated conditions for example, in an estimated request, and the estimated amount of money in an estimated reply besides the time which is the status-control information shown in drawing 15 . When referring to progress, such information is effective in order to grasp not only time but the contents of progress.
[0106] 1 which shows development progress of each module of the product developed, or components if the above configurations are used -- when -- drawing creation -- starting -- 2 -- when -- a drawing -- completing -- 3 -- when -- estimating -- requesting -- 4 -- when -- an estimated reply -- coming out -- 5 -- order arrangements are carried out when -- having -- 6 -- it supplies when -- having -- 7 -- prototype directions are carried out when -- having -- 8 -- it can grasp [when it was manufactured and].
[0107] The example in the case of displaying the status-control information stored in the status-control information storing section 1404 by the status-control information-reference section 1405 is shown in drawing 16 . As a transcription of progress, there are a time display format (drawing 16 (1)) and a graphical display format (drawing 16 (2)), for example.
[0108] According to a time display format, as shown in drawing 16 (1), a tabular format shows the time 1601 by which the nomenclature 1610 which constitutes the product currently developed and the time about status-control information, i.e., the engineering-drawing plot start date 1611 - the manufacture completing date 1618, and the present time, and these status-controls information were updated to the output screen 1600 of the output unit of this example. Moreover, a non-started thing is a blank among the above-mentioned status-control information, and what was carried out displays the time.
[0109] In this Fig., about the cabinet 1602 which is one of the component parts of the product currently developed, although the estimated request day 1603 is on January 15, the reply 1604 to it shows the condition of not being obtained, for example.
[0110] In the graphical display format, as shown in drawing 16 (2), in order to show that the processing corresponding to the above-mentioned status-control information 1611-1618 was completed, the specific marks 1621-1628 by the color, patterns, or those combination are decided for every information.
[0111] In addition, the above-mentioned status-control item is an index which shows the progress situation of a product directly. That is, for example, whenever it decides on every one time of the above-mentioned status-control item in drawing 16 (1), it is shown that development of a product is progressing. For this reason, below, the processing corresponding to each of the above-mentioned status-control item is called the progress step in development.
[0112] The graphical display format shows further the progress situation of the module of each node, or components in the progress steps (processing corresponding to the above-mentioned status-control item) 1611-1618, and the bill-of-materials tree expressed using correspondence relation with the marks 1621-1628 assigned for every progress step, and the mark determined with this correspondence relation to the output screen 1600. Drawing 16 (2) expresses the same thing as the progress situation shown in drawing 16 (1) as the mark which was able to be decided the account of a top.
[0113] although strict time is not known in this graphical display format, there is goodness that, for example, a whole situation can grasp the color used for a mark at a glance by making it deep according to advance of a progress situation since it is thin.
[0114] Moreover, although an indication is given about the processing performed at the time newest stage in this example, it is good also as a format similarly expressed about all processings performed until now using a mark, for example.
[0115] Next, an operation of this example is explained using drawing 17 , drawing 18 , drawing 19 , and drawing 20 .

[0116] In this example, the fixed form electronic mail collection section 1412 collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development. The fixed form electronic mail collection section 1412 is taken as a configuration equipped with the mail server 1801 which performs collection of an electronic mail, issue, etc., as shown in drawing 18 .
[0117] The fixed form electronic mail in this example can fixed-form-ize the contents with the class, the time, and the contents attribute of e-mail, as shown in drawing 19 . Here, the class of e-mail corresponds to the status-control item stored in the status-control item storing section 1401, and has the request-for-quotation mail 211 and estimated reply mail 212 grade. Time shows the date of issue of e-mail. A contents attribute corresponds to the class of the mail, and a request-for-quotation number and the estimated amount of money are contained as a contents attribute of the estimated reply mail 212.
[0118] Such a fixed form electronic mail can be created and transmitted by performing actuation of following the flow chart shown in drawing 20 in an electronic mail transmit terminal equipped with the actuation screen 1700 as shown in drawing 17 .
[0119] That is, the class of electronic mail which it is going to send is first chosen from a menu 1701 (step 1201). Here, the class of selectable mail is determined that it will correspond to the status-control item memorized by the status-control item storing section 1, uses the class of mail as shown in drawing 6 as a selection branch, and sets it up.
[0120] Next, the contents attribute corresponding to the class of selected mail is inputted (step 1202). By drawing 17 , to the class "an estimated request" of mail chosen with the menu 1701, the input column 1702 of a contents attribute "drawing-for-estimate watch" required for it is displayed, and the condition that information required for it is inputted is shown. The contents attribute inputted at this step corresponds to the class of mail chosen at the above-mentioned step, and, specifically, is information as shown in the column of the contents attribute of drawing 19 .
[0121] Finally, the transmission place of e-mail is chosen from a menu 1703 (step 1203). Here, as a transmission place, the section related to development shall be included at least. In the e-mail sentence 1704 created as mentioned above, information about the date of issue and the section of a publishing agency is added and published further.
[0122] In this example, although an example of the approach of carrying out creation issue of the fixed form electronic mail using a menu was explained, if an electronic mail including information which was illustrated by drawing 19 can be created, in this invention, the concrete configuration of the creation approach or listing device will not be limited.
[0123] The fixed form electronic mails which were created in each section as mentioned above, and were published are once collected by the mail server 1801 of the fixed form electronic mail collection section 1402, as shown in drawing 18 . Next, the status-control information monitoring section 1403 chooses an electronic mail including the information about the status-control item stored in the status-control item storing section 1401 among the they-collected fixed form electronic mails, extracts the information concerned from the selected electronic mail, and the status-control information storing section 1404 is made to memorize it.
[0124] According to the flow chart shown in drawing 18 , the status-control information monitoring section 1403 reads an electronic mail from a mail server 1801 at first (step 1811), and, specifically, the class of read electronic mail is extracted (step 1812).
[0125] Next, it investigates whether it corresponds to mail of the format that the class of extracted electronic mail contains one of the status-control items 1802 defined by the status-control item storing section 1401 (step 1813). If it does not correspond to mail of the format containing one of the status-control items 1802 (it is No at step 1813), nothing is processed but it considers as termination.
[0126] When it corresponds, Yes), and the date and contents attribute of this mail are taken out at the (step 1813 (steps 1814 and 1815), they are stored in the predetermined progress attribute column of the status-control information storing section 1404 (step 1816), and processing is ended.
[0127] Whenever it comes to a mail server 1801, it performs, or there is an approach a new electronic mail checks new mail of a mail server 1801 periodically as an approach of starting processing of the above status-control information monitoring sections 1403.

[0128] Moreover, it is good also as a configuration to which the status-control information monitoring section 1403 is set with one of the transmission places of e-mail, and all electronic mails are automatically transmitted by the status-control information monitoring section 1403. According to such a configuration, the status-control information monitoring section 1403 can receive an electronic mail, without minding the fixed form electronic mail collection section 1402.
[0129] Processing of the electronic mail by the status-control information monitoring section 1403 which was illustrated in the above-mentioned example is realized by fixed-form-izing the format of the message contained in an electronic mail like an e-mail class, time, and a contents attribute.
[0130] Next, in this example, the concrete example using the information about the status-control item about the function of a development product is explained using drawing 21 . Here, as one gestalt which memorizes a status-control item, the information which shows the whole product or the operation result of count of the property of a part or an experiment is stored in the status-control information storing section 1404 at the functional attribute column 2100 so that the progress situation about the function of a product can be expressed.
[0131] In development of a product, count conditions and the count approach are changed, multiple-times operation may be carried out, the experiment about a functional characteristic also changes experiment conditions and the target experimental model, and multiple-times operation of the count of the functional characteristic of a product may be carried out. The experiment about the computation of such a functional characteristic or a functional characteristic has many which are beforehand defined corresponding to categories, such as a form of a product.
[0132] Therefore, whenever [whenever / achievement / to the function of the product currently developed], i.e., the progress situation in the functional whole surface of development, can be measured by carrying out monitoring of these computations and experiment processings. For this reason, in this example, the functional attribute column 2100 which stores the operation result of count of a property or an experiment has the tabular format which can store the operation result of multiple times about the functional characteristic which it is going to search for.
[0133] The contents of the information stored in the functional attribute column 2100 are extracted from the fixed-form-ized electronic mail which is used in case each person in charge persons, such as a design, analysis, and a trial section, do operating communication about a development test, and are stored.
[0134] For example, if a request of the count about the functional characteristic over the components which the design section person in charge designed is performed using the fixed form electronic mail 2111 to an analysis section person in charge, the mails 2111 will be collected by the fixed form electronic mail collection section 1402. The monitor of the information 2101 on the collected electronic mail 2111 is carried out by the status-control information monitoring section 1403, and it is stored in the column of the count conditions of the functional characteristic which the count conditions of the mail 2111 make the object in the status-control information storing section 1404.
[0135] Moreover, when the analysis section person in charge who received this property count request electronic mail 2111 performs a property count result using the fixed form electronic mail 2112, the monitor of that mail 2112 is carried out by the status-control information monitoring section 1403, and the count result included in the information 2102 on that mail 2112 is stored in the column of the count result of the functional characteristic made into the object in the status-control information storing section 1404.
[0136] Moreover, the conditions of a functional characteristic experiment and arrangements directions, and a report of an experimental result are also stored in the predetermined column of the status-control information storing section 1404 by carrying out the monitor of the information 2103 and 2104 on the fixed-form-ized electronic mails 2113 and 2114 like the above, respectively.
[0137] Thus, count and an experiment of the whole product or the property of a part are conducted when, and by referring to the functional attribute column 2100 into which information was inputted shows what kind of result was obtained.
[0138] Next, other examples of the development progress monitoring system which applied this

invention are explained using drawing 22 . In order to carry out monitoring of the development progress situation about the function of a development product, the information on the count directions to the computer in implementation of count of the functional characteristic of the development product is used for this example.
[0139] the communication Management Department 11 of this example shows drawing 22 -- as -- development tools 101 and 102 -- the information on the count directions sent to a computer 2200 from ... development tools 101 and 102 -- it has the configuration which carries out monitoring through the information network 104 where ... and a computer 2200 are connected.
[0140] The status-control item storing section 1401 which stores the status-control item which this example makes the index of the status control defined beforehand, The count directions monitoring section 1406 which extracts the information about the status-control item included in the count directions information sent to a computer 2200, The status-control information storing section 1404 which stores the extracted information as status-control information, It has the status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section 1404, and the I/O section (not shown) which displays a processing result while receiving the actuation from the outside.
[0141] As a status-control item memorized by the status-control item storing section 1401, the directions information on count about the product or components concerned which are performed by the computer 2200, such as estimated count about a development product or its component part and count of a functional characteristic, can be used, for example.
[0142] Although monitoring of the contents of the electronic mail of operating communication exchanged among the development persons concerned was carried out in the above-mentioned example, monitoring of the information on count directions [instead of an electronic mail] is carried out from the developer to the computer 2200 in this example.
[0143] In the configuration of this example, it does not grind status-control information monitoring section 1403 with the fixed form electronic mail collection section 1402 contained in the above-mentioned example, instead has the count directions monitoring section 1406. It is judged whether it corresponds to the status-control item memorized by the status-control item storing section 1401 like the processing in the above-mentioned example shown in drawing 18 , when it corresponds, the contents are extracted, and the contents of the count directions by which monitoring was carried out are stored in the status-control information storing section 1404.
[0144] Since it is not necessary to prepare the electronic mail collection section according to this example, without collecting and carrying out monitoring of the electronic mail, a system configuration can be simplified more and becomes possible [grasping the development progress situation of the functional characteristic of a product].
[0145] Next, other examples of the development status-control system which applied this invention are explained using drawing 23 .
[0146] This example sets the time of the scheduled completion date of the processing corresponding to each status-control item as the status-control information storing section 1404, and displays the comparison display with a completion schedule and an actual progress situation, and the status-control item delayed for the completion schedule.
[0147] The status-control item storing section 1401 which stores the status-control item made into the index of the progress defined beforehand as this example is shown in drawing 23 , The fixed form electronic mail collection section 1402 which collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development, The status-control information monitoring section 1403 which extracts the information about the status-control item included in the collected electronic mail, The status-control information storing section 1404 which stores the extracted information as status-control information, The status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section 1404, It has the I/O section which displays a processing result while receiving the actuation from the outside, and the status-control information setting section 1407 which sets up the termination scheduled day of

the processing corresponding to the above-mentioned status-control item.
[0148] In this example, the configuration and operation of the requirements for a configuration of those other than status-control information setting section 1407 are the same as the example of drawing 14 , and explanation here is omitted.
[0149] In this example, a setup at the time of the termination scheduled day of the processing corresponding to the above-mentioned status-control item by the status-control information setting section 1407 is performed through the display screen 1600 of the output unit of the I/O section as shown in drawing 24 . Scheduled day setting processing of this status-control information setting section 1407 is started by clicking the schedule setup key 2401 prepared on the display screen 1600 with input units, such as a mouse or a keyboard. In addition, drawing 24 shows the condition of the screen 1600 after this scheduled day setting processing was started.
[0150] In Screen 1600 which performs a schedule setup, the name 1610 of the component part of a development product and the processings 1611-1618 corresponding to the above-mentioned status-control item are shown by the tabular format. In order to input the termination scheduled day, an operator specifies the column which is going to input on Screen 1600 with a mouse etc., and inputs the date from a keyboard. The status-control information setting section 1407 accepts these directions, and sets up the scheduled day for every processing corresponding to the status-control item of each part article.
[0151] Moreover, in a setup of the scheduled day, it is good also as structure where it does not input like this example, respectively, for example, the standard period is beforehand set up for every processing concerned, and the termination scheduled day about the processing after the inputted processing can be set up automatically.
[0152] In this example, the status-control information-reference section 1405 can be started after a scheduled day setup by the status-control information setting section 1407, and displaying collectively the time of the termination scheduled day of the processing corresponding to each status-control item and the actual end date stored in the status-control information storing section 1404 can compare a schedule and an actual progress situation.
[0153] Display processing of the status-control information-reference section 1405 is clicking the progress reference carbon button 2402 prepared in Screen 1600 for setting up the scheduled day shown in drawing 24 , and is started.
[0154] As a display gestalt, there are a time schedule / a track record display format (drawing 25 (1)) which displays a time schedule and a track record by several characters in all, and a graphical display format (drawing 25 (2)) displayed by the mark which defined beforehand whether the actual progress situation would be behind the schedule, for example.
[0155] In addition, drawing 25 (1) and display selection of (2) are performed by clicking either among the time carbon button 2503 newly displayed by clicking the progress reference carbon button 2402 prepared on Screen 1600, and the alarm carbon button 2504.
[0156] In a time schedule / track record display format, as shown in drawing 25 (1), the termination scheduled day 2505 and the actual end date 2506 display collectively to each of the processings 1611-1618 corresponding to a status-control item.
[0157] As shown in drawing 25 (2), a graphical display format expresses by the mark 1105 which changed the color and the pattern, and the mark 1106 so that the difference between the processing corresponding to the status-control item which is behind the schedule, and the processing which is not behind may appear clearly.
[0158] Moreover, it is good also as a configuration which the processing name which combined the transcription by the mark equipped with the color or pattern corresponding to each processing of a status-control item like the graphical display format of this example and the display format of drawing 16 , and is behind the schedule can specify concretely.
[0159] Since according to this example the termination scheduled day can be set up for every corresponding processing with a status-control item and it can be compared with an actual processing date, the progress situation of development can grasp more clearly.

[0160] Next, communication of problem generating performed between a design section and a trial section is explained using drawing 26 . When a problem occurs during a trial in a trial section, it is necessary to connect with a correspondence section immediately. Now, a problem occurs, and when the correspondence section is a machine design section, a trial section must connect immediately the contents of the problem generated during the trial. Since the person in charge of a design section cannot be in a seat in the case of a telephone, communication mail is transmitted using the communication Management Department 11. Drawing 26 is drawing showing an example of the dispatch screen of this communication mail. Drawing 26 is a screen for transmitting the problem generated while the trial section examined. In the problem communication mail dispatch screen 900 of drawing 26 , it has the examiner selection column 901 which chooses an examiner name, and the designer selection column 902 which chooses a designer name. This is the relation between an addresser and the destination as used in the field of common mail. Thus, it can set up by choosing from a menu by scrolling. Suppose that it generated now while the problem "the noise of a motor was loud" examined. Although an examiner sends e-mail immediately when a problem occurs during a trial, the procedure chooses a motor from classification 1 first. This classification 1 list 904 is a category which mainly points out a location and components. When choosing classification 1 list 904, in classification 2 list 903, the class of measurement value corresponding to the location and components of classification 1 list 904 appears. If a "sound" is chosen here, since the example of the mail which is related to a sound will be displayed on a menu 905, when this message "the noise is loud" is chosen and a dispatch carbon button is pushed, problem communication mail is stored in the problem hysteresis storing section 151 of the informative matter storing section 15 by the communication Management Department 11, and it is transmitted that new mail reached the design. Moreover, the sent mail is displayed on the dispatch hysteresis management display 906 with submission time. Deletion is performed by pushing a deletion carbon button to delete the sent mail from hysteresis, and cancellation of transmitted mail can be performed.
[0161] Next, the handling of the above-mentioned communication mail in a design section is explained using drawing 27 and drawing 28 . Its identifier of the designer who received the above-mentioned communication mail is [however] red, and he blinks. [of the menu 2701] This menu 2701 details to people's identifier what divided the user into the trial section with the machine design, the electrical design, and the prototype in the above. Drawing 27 shows that communication mail has reached "Suzuki." At this time, the laboratory name currently used for the laboratory name display 2702 which corresponds if the contents of e-mail are displayed is displayed, the test condition of the trial item which the problem generated is displayed on the condition display 2703, and the problem communication mail with which it was transmitted further is displayed on the communication mail display 2704. Beforehand, since it is stored in the informative matter storing section 15 by the communication Management Department 11, experimental measurement data can display a test data on a screen, if relating of measurement data and problem communication mail is performed. It is drawing 28 which showed the display to the above-mentioned designer. If e-mail is chosen in drawing 27 , as shown in drawing 28 , the graph of measured value can be displayed. The display of this graph graph-izes the data of the parameter name which should be displayed from the correspondence table which described the relation between the measured-value name shown in drawing 29 , and mail. item **** 2902 of drawing 29 -- for example, "motor noise -- it is large -- " -- ** -- it is the part the parameter group which should be displayed to the said problem communication mail is described to be. Thus, when one problem generates the parameter related to a problem class and its problem by using a relating beam table, it is not necessary to consider what kind of measured value should be referred to for cause investigation of the problem, and is effective in the ability to perform cause investigation very efficiently. That is, since a measurement result can be grasped on real time, even if a problem occurs, it has the features that it can shift to cure examination and cure implementation quickly.
[0162]
[Effect of the Invention] As mentioned above, according to this invention, the whole development project of a product development, the desired value of a part and an advance predicted value, and the development support system that can support mutual adjustment management can be offered.

[0163] Furthermore, this invention carries out monitoring of the information concerning development progress automatically [when the person in charge concerning development performs operating processing indispensable to development about the part which he takes charge of] out of the electronic mail used for the processing, stores the information as status-control information, and each developer enables it to refer to progress of the whole development. Here, especially the information about the status-control item by which a monitor is carried out is not acquired by exchanging the wording of a telegram for development management.
[0164] Therefore, according to this invention, like the conventional development support system, a man day special for development management is required, therefore the problem that development management serves as a burden for a developer is solved.
[0165] Furthermore, according to this invention, the problem currently mentioned as a problem at the time of using the conventional development support system that the objective information gathering for development management is difficult is solved.
[0166] That is, since the development activities itself were human being's intellectual activities, therefore, the information about the progress situation mainly required it for self-assessment of each developer conventionally. On the other hand, since a production activity has a product in which process or was visible, objective progress has grasped it objective easily. Be [going to differ / just / these points / of the status control of development activities, and the status control of a production activity / greatly]
[0167] Therefore, in development management, the subjective information returned voluntarily is mainly used and suited conventionally the condition of saying that it is difficult to collect objective progress information. For this reason, in the conventional development support system, however it might have the advanced function manager, there was a problem that objective and effective development management could not be performed.
[0168] In this invention, monitoring of the information for measuring a progress situation is not automatically carried out to development from the information about indispensable operating processing, and it is not based on self-assessment of each developer. For this reason, it does not differ from the actual condition of development progress.
[0169] Therefore, according to this invention, the biggest problem of the conventional development support system is solved in that the information about the objective progress most important for effective development management can be acquired.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the development support system which offers two or more development persons' in charge coordination work environment especially about the development support system which is used at a company, works, etc. and which supports development of a new product.

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PRIOR ART

[Description of the Prior Art] Conventionally, as a system which supports the coordination activity by two or more users, the system given in JP,3-250365,A is known, for example.
[0003] According to this system, a meeting can be held from the location which two or more persons left in the phase phase of the business currently performed as a group using two or more information processors, for example, the situation of each activity which each has done separately can be grasped, and it can return to each activity based on this result.
[0004] Moreover, as a system which manages the other conventional development, the system given in JP,4-364529,A is known, for example. This conventional technique performs development management of software in development of the software by two or more developers by exchanging the electronic mail which prepares the contents concerning each module development, i.e., an instruction code item, a project name item, an activity code item, an activity data item, a requesting agency item, a trustee item, a period item, and a priority item in the wording of a telegram (electronic mail) used for the communication link between developers, and contains such development management information in it.
[0005] Without according to such a system, being influenced by a communication partner's convenience since an electronic mail is used, the matter concerning development can be notified and development management without the need of preparing printed matter, such as a document, further can be performed.

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, according to this invention, the whole development project of a product development, the desired value of a part and an advance predicted value, and the development support system that can support mutual adjustment management can be offered.
[0163] Furthermore, this invention carries out monitoring of the information concerning development progress automatically [when the person in charge concerning development performs operating processing indispensable to development about the part which he takes charge of] out of the electronic mail used for the processing, stores the information as status-control information, and each developer enables it to refer to progress of the whole development. Here, especially the information about the status-control item by which a monitor is carried out is not acquired by exchanging the wording of a telegram for development management.
[0164] Therefore, according to this invention, like the conventional development support system, a man day special for development management is required, therefore the problem that development management serves as a burden for a developer is solved.
[0165] Furthermore, according to this invention, the problem currently mentioned as a problem at the time of using the conventional development support system that the objective information gathering for development management is difficult is solved.
[0166] That is, since the development activities itself were human being's intellectual activities, therefore, the information about the progress situation mainly required it for self-assessment of each developer conventionally. On the other hand, since a production activity has a product in which process or was visible, objective progress has grasped it objective easily. Be [going to differ / just / these points / of the status control of development activities, and the status control of a production activity / greatly]
[0167] Therefore, in development management, the subjective information returned voluntarily is mainly used and suited conventionally the condition of saying that it is difficult to collect objective progress information. For this reason, in the conventional development support system, however it might have the advanced function manager, there was a problem that objective and effective development management could not be performed.
[0168] In this invention, monitoring of the information for measuring a progress situation is not automatically carried out to development from the information about indispensable operating processing, and it is not based on self-assessment of each developer. For this reason, it does not differ from the actual condition of development progress.
[0169] Therefore, according to this invention, the biggest problem of the conventional development support system is solved in that the information about the objective progress most important for effective development management can be acquired.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, the development project which develops a certain new product is each phase of a project, and it is necessary to carry it out, adjusting the desired value of the whole development project, the advance predicted value of the whole development project, the desired value of project each activity, and the advance predicted value of project each activity mutually.
[0007] However, supported by the coordination activity by the mere information interchange in the 1st conventional support system mentioned above, the user itself has to manage such all adjustments.
[0008] For this reason, even if it uses such a conventional support system, the burden which a user has to pay to management of target achievement, such as engine performance of a development product, the cost price, and a schedule, etc. is fully unmitigable.
[0009] That is, in the conventional support system, it cannot be said that this **** desired value of the whole development project and a part and **** advance predicted value, and mutual adjustment management are fully supported.
[0010] When the exchange of the wording of a telegram for said development management is needed and there is no exchange of this wording of a telegram, it becomes impossible moreover, to completely perform development management in the 2nd conventional system mentioned above. Moreover, even if a developer does a different report from the actual condition of progress, it does not have the function which checks it.
[0011] Then, this invention sets it as the 1st purpose to offer the whole development project of a product development, the desired value of a part and an advance forecast, and the development support system that can support mutual adjustment management.
[0012] Moreover, even if especially this invention does not exchange the wording of a telegram for development management, a burden is not applied to a developer and it sets it as the 2nd purpose to offer the development progress monitoring means which can carry out monitoring of the progress situation objective.

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MEANS

[Means for Solving the Problem] It is the system by which this invention supports development of the product by two or more development persons in charge for said 1st purpose achievement. The model of a product, A means to store the resource model which stores the model of the resource used for a product development, and the model of an activity of a product development, A means to store the desired value of the cost price of a product, the engine performance, and the whole development schedule, and the desired value of each part, A means to presume the advance predicted value of the cost price, the engine performance, and a development schedule from said each model, A means to support reference of said each model and each desired value by each development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and modification of each model, In judging whether said each advance predicted value satisfies desired value when circumstantiation is performed, and not being satisfied at least, it offers the development support system characterized by having a means to notify a user of that.
[0014] For said 1st purpose achievement, moreover, this invention It is the system which supports development of the product by two or more development persons in charge. The model of a product, A means to store the resource model which stores the model of the resource used for a product development, and the model of an activity of a product development, A means to store the desired value of the cost price of a product, the engine performance, and the whole development schedule, and the desired value of each part, A means to presume the advance predicted value of the cost price, the engine performance, and a development schedule from said each model, A means to support reference of said each model and each desired value by each development person in charge, and each advance predicted value, A means to support modification of said each model by the development person in charge, and circumstantiation, and a means to support modification of said each desired value by the development person in charge, and circumstantiation, When modification of desired value and circumstantiation are performed, the adjustment of whole desired value and partial desired value is evaluated, and when it is mismatching at least, the development support system characterized by having a means to notify a user of that is offered.
[0015] Moreover, two or more persons in charge whom the 2nd purpose of the above requires for development of a product transmit and receive electronic information mutually. Development of said product which carries out sequential completion of two or more processings produced in connection with the business concerning development of said product It is the development progress monitoring means in the system to support which carries out monitoring of the development progress situation of said product. The status-control item storing section which establishes two or more items corresponding to each of the processing of said plurality performed by transmitting and receiving said electronic information, and stores one or more of items of it as a status-control item used as the index of development progress of said product, The status-control information monitoring section which is contained in said electronic information and which extracts the information about said status-control item, It is attained by the development progress monitoring means characterized by having the status-

control information storing section which stores said extracted information as status-control information, and the status-control information-reference section for referring to said status-control information stored.

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OPERATION

[Function] In according to the development support system concerning this invention judging whether said each advance predicted value satisfies desired value when modification of each model and circumstantiation are performed, and not being satisfied at least, it notifies a user of that.
[0017] Moreover, when modification of desired value and circumstantiation are performed, the adjustment of whole desired value and partial desired value is evaluated, and when it is mismatching at least, a user is notified of that. Therefore, each person in charge person of a product development can form the optimal plan for target achievement, checking the adjustment of the whole obtained from a design result objective while detailing with development planning for which the detail has not opted in the beginning of development to progress of development and the advance predicted value of each activity, and desired value, and the adjustment of the desired value of the whole activity, and the desired value of each activity.
[0018] Furthermore, in the development progress monitoring means by this invention, out of the information which the person in charge concerning the above development transmits and receives, monitoring of the information about said status-control item which is the information concerning development progress automatically is carried out, and the information is stored in the status-control information storing section. The progress situation of development can be grasped because each development person in charge or a development status-control person refers to this status-control information stored.
[0019] Thus, since especially the information about a status-control item is not acquired by exchanging the wording of a telegram for development management, it does not necessarily require a man day special for development management. Moreover, without differing from the actual condition of progress, since monitoring of this information is carried out to development from the electronic mail concerning indispensable operating processing, a man day cannot newly be applied but ** can also carry out monitoring of the progress situation objective.

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EXAMPLE

[Example] Hereafter, one example of the development support system concerning this invention is explained.
[0021] In this example, development members, such as a development manager, a machine design person, an electrical-design person, a prototype manufacturer, and a prototype-test person, are assumed as a user of a development support system.
[0022] The configuration of the development support system applied to drawing 1 at this example is shown.
[0023] The client machine with which each development member uses 1000, respectively, and 2000 are server machines which process according to the demand of each client machine 1000 among drawing.
[0024] Each client machine 1000 is equipped with the model creation section 1 which it uses in case a development member creates a product model, a development activity model, and a resource model, and the created model is stored in the product model storing section of 2 of a server machine 2000, the development activity model storing section of 3, and the resource model storing section of 4, respectively.
[0025] In addition, the structure of a product, an attribute, a property, etc. are described by the product model. Moreover, the precedence relation between activity units, a schedule, a track record of an activity, etc. are described by the development activity model for every activity unit which divided the activity of the whole development into the partial activity. And the capacity of a facility and the information on a development pursuer which development, such as a manufacturing facility, a test facility, etc. of a prototype, takes are described by the resource model. The development activity model links the product model and resource model about the activity, as shown in drawing 2 .
[0026] Next, the cost presumption section which presumes the cost price from the product model with which the development activity model linked five in a server machine 2000, the engine-performance presumption section which presumes the engine performance from the product model with which the development activity model linked 6, and 7 are the schedule presumption sections which presume a development schedule from development rating and a resource for every unit of a development activity model, and the estimate which these presumed is stored in the estimate storing section of 8. In addition, each estimate is respectively stored in the cost estimate storing section 81, the engine-performance estimate storing section 82, and the schedule estimate storing section 83.
[0027] Moreover, the desired value of the cost price, the engine performance, and a schedule is stored in the desired value storing section of 12. This desired value is determined in the time of development, using the desired value assignment section of 13 as a result of a plan and a design, and is stored in the desired value storing section 12.
[0028] The desired value stored in the desired value storing section 12 is changed with advance of development, or is detailed. Although this modification and circumstantiation are performed by deliberations and decision of each development member, the communication Management Department of 11 manages modification and circumstantiation of these deliberations and decision, and the desired value based on this.

[0029] Although the cost price and the engine performance which it was previously described as this desired value, and the estimate of a schedule are not necessarily in agreement, development activities must be managed so that it may be in agreement with desired value.
[0030] In order to realize such management, estimate and the desired value review section 9 check the difference between estimate and desired value, and a development member can be told or it enables it to refer to this through a client machine 1000. Moreover, desired value has the partial desired value of various level, and these partial values and the whole value must take adjustment. The whole and the partial adjustment maintenance section 10 check this adjustment, when adjustment collapses, it tells a development member about it through a client machine 1000, and it is made not to change desired value which breaks down adjustment.
[0031] Next, the example of a configuration of the development activity model stored in drawing 2 at the development activity model storing section 3 is shown.
[0032] As shown in drawing 2 , the development activity model stored in the development activity model storing section 3 expresses the precedence relation as an activity unit in a graph.
[0033] Moreover, in each activity unit, a predetermined value, a track record value, etc. of initiation of a development activity name, the responsibility person in charge of development activities, the constraint of development activities, the resource model used for development activities, the product model referred to at the time of development activities, the product model in which the result of development activities is shown, and an activity, and a termination stage are described, for example so that it may illustrate.
[0034] Thus, although the schedule and track record of development activities are shown to a development activity model by the unit of development activities, this schedule is detailed with advance of development, and also produces modification. This is inevitably generated from it being the activity in which a product development contains many indefinite elements. Then, when the contents of the development activity model are changed, this development support system presumes the effect to the schedule, the cost price, and the engine performance, as shown in the following examples, and connects relation with desired value to each development member.
[0035] Thereby, the grasp evaluation of the effect of modification of a development activity model can be carried out easily, it can form the plan to the completion of development which satisfies each desired value based on each prospect in a time, and can describe each development member to a development activity model.
[0036] Hereafter, managing about each of the cost price, the engine performance, and a schedule, so that such desired value and estimate may have consistency, the case where each development member furthers development in cooperation is taken for an example, and actuation of the development support system concerning this example is explained.
[0037] First, the actuation in the case of furthering development is explained, managing a development schedule.
[0038] First, the schedule assignment section 320 in the desired value assignment section 13 sets the schedule target at the time of development initiation as the desired value storing section. As for this desired value setup, plan / design charge of a new product sets the sale stage of a new product. And the schedule assignment section 320 inputs data, such as the conventional development track record, and performs a schedule assignment for every unit of development activities required to refer to this and realize the set development stage.
[0039] Then, it is 601 which presumes rating also about non-started development activities during a design, and is set up to a development activity model in an activity plan while design persons in charge, such as machine electrical and electric equipment, design their part in their duty shown with a development activity model and storing a design result in the product model storing section 2 as shown in drawing 6 for example.
[0040] Moreover, 602 [store / to the resource model storing section 4 / resource data rating is presumed concerning non-started development activities during an activity in storing the activity result of each part in its duty not only a design person in charge but the person in charge of a prototype and a trial is

indicated to be with a development activity model to the product model storing section 2 ****, and an activity plan can be set as a development activity model, or it can be used to development, such as a facility and a staff,].

[0041] It is 604 which presumes subsequent development schedules and stores schedule estimate in the estimate storing section 8 using the development facility which the schedule presumption section 7 grasps the development advance situation and the remaining development rating at that time from this development activity model, and is stored in 603 and the resource model storing section 4, or a staff's data.

[0042] Here, the count method of the schedule presumption section 7 is explained using drawing 8 . Drawing 8 is a flow chart showing the computational procedure of the schedule presumption section 7. 801 which acquires the schedule data of the present condition of an object project from the development activity model storing section 3 first in the schedule presumption section 7. Next, 802 which acquires the information about a resource from the resource model storing section 4. Next, although count of whenever [progress] is performed, in 804 and this invention, the remaining man days are presumed using the definition of whenever [progress / as shown in drawing 9]. Two indexes shown in drawing 9 are 805 which is what presumes the remaining man days by the statistical analysis of the termination situation of an operation item. An index 1 is an index which presumes the remaining man days to be the operation items ended by the presumed point in time from the man day which it took, and an index 2 is an index which presumes the remaining man days from the problem solved by the presumed point in time, and the man day which it took. The problem is a problem which checks advance of a project, for example, are the various troubles generated in the experimental model in the trial process of the experimental model in the development process of a new product here. In addition, an index 1 can carry out schedule presumption in a project at large by processing which avoids this, although there is [a denominator] the singular point of 0 at the time of initiation of a project, and an index 2 also has the singular point when the number of solution problems is 0.

[0043] Estimate and the desired value review section 9 compare schedule estimate with the schedule desired value corresponding to it, and a development member enables it to refer to 605 and its information.

[0044] Thus, it is 606 which estimate and the desired value review section 9 tell this information to a development member when it becomes clear that an activity progresses and schedule estimate cannot attain schedule desired value, and requires a cure.

[0045] Drawing 10 is a flow chart showing the procedure of the above-mentioned processing of estimate and the desired value review section 9. Estimate and the desired value review section 9 are 1001 which acquires termination estimate from the schedule estimate storing section 83 first. Next, 1002 which acquires termination desired value from the schedule desired value storing section 123. Next, 1005 which generates the message of warning when it is over the threshold as which these differences were calculated and the value of 1003 and delay was determined beforehand. The receiver's address data of a message are also added to this warning message. Thus, according to estimate and the desired value review section, it is in the middle of advance of a project, and the visualization of the plan is carried out immediately and the early cure of it is attained one day [in question].

[0046] There are modification of the sequence of the development activities which serve as a neck as a cure after target attaining, enhancement of a development resource, etc. Since other development activities are influenced in any case, the deliberations 607 of a development member are needed. The communication Management Department 11 is 608 which changes the desired value of the desired value storing section 12, or changes a resource model and a development activity model based on the discussed contents. From the changed development activity model, the schedule presumption section 7 re-presumes subsequent development schedules, and stores schedule estimate in the estimate storing section 8.

[0047] The whole and the partial adjustment maintenance section 10 evaluate the contents which were discussed and judged and were reflected in the desired value storing section 12 on the other hand. And since the information is told to a development member when there is mismatching of estimate, desired

value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.

[0048] The example shown above is explained to a detail using the example of a screen. Drawing 11 is drawing showing the example of 1 screen for specifying the schedule of the activity item (activity unit) in a development activity model. Here, a design is completed and the performance test phase for checking achievement of the target engine performance to an experimental model is explained to an example. In the case of this example, an activity item (activity unit) serves as a thing of an engine-performance verification-test item. Here, since the case where a trial section performs the schedule control of a performance test is made into the example, in the window 1100 which displays the carbon button group which expresses a user first as shown in drawing 11 , the carbon button corresponding to a trial section is chosen, and it goes into a scheduling screen.

[0049] all the operation item displays 1103 that a scheduling screen carries out in this project with the project name display 1101 for a plan, and the project termination schedule display 1102, the resource display 1104 for performing this operation item, the standard duration display 1105 of this operation item, and the schedule display 1106 that displays a schedule by the die length based on a standard duration -- ** -- since -- it is constituted. For example, supposing today's date is September 2, display Rhine 1107 will be displayed on the part of an applicable date on the day. As mentioned above, the die length of the schedule bar 1108 turns into die length corresponding to the standard duration displayed on the standard duration display 1105. A project name is inputted by the keyboard in the model creation section 1 of a client machine 1000. The inputted project name is stored in the development activity model storing section 3. The project termination scheduled day currently displayed on the project termination schedule display 1102 shows the end date stored in the development activity model storing section 3, and setting modification is possible for it at the desired value setup key 1102. Processing of a desired value setup key is a carbon button for processing a desired value setup of the communication Management Department 11. The project termination presumption day currently displayed on the project termination schedule display 1102 is a schedule stored in the estimate storing section 8, and this is the value which the schedule presumption section 7 calculated as it was explained using drawing 8 . When a presumed termination schedule is compared with this project termination desired value, a system blinks the carbon button of the "trial section" which is a schedule-control person in the window 1100 which displays the carbon button group showing a user as warning.

[0050] Next, the operation situation input carbon button 1109 is explained. After one operation item is completed, whether the item was completed needs to be checked of such a trial process. It is because it can say that the design of a product was ended only after clearing all the operation trial items. Then, the means for inputting situations, such as "success", a "rejection", and "a hold", to each item is this operation situation input carbon button 1109.

[0051] Next, copy/migration carbon button 1110 is explained. Between operation items, precedence relation is defined beforehand. This is specified in the model creation section 1 of a client machine 1000 at the time of early planning, and expresses the restricted relation to activation of the item "Item B cannot be performed unless Item A is passing." The copy of the item which had such precedence relation, and interlocking migration are explained using drawing 12 . Here, suppose that precedence relation is beforehand defined between Item B and Item C. That is, Item C can be performed until Item B is "passing." First, "a copy" is explained. Since Item B was not passing, (a) of drawing 12 shows the situation of performing Item B again two days after. It is realizable with the actuation in this system by copying the trial item which corresponds using a copy carbon button. By this copy, all item attributes other than an item enforcing date are copied. If it specifies that it performs Item B two days after after copying, as shown in [in the right figure of drawing 12 (a)], Item C will interlock and will move following Item B. At this time, the schedule which opened is packed automatically and the schedule after it shifts automatically back. Next, "migration" is explained. (b) of drawing 12 expresses the case where Item B is shifted compulsorily two days after, when Item B is not able to be performed by a certain cause on the first plan day. In this case, if Item B is shifted two days after, Item D and Item E which the item C which had precedence relation carried out interlocking migration automatically, and

were in the schedule which opened back will be packed automatically. The right figure of drawing 12 (b) shows this result. By having defined precedence relation between such items, the plan of the item which should be carried out is mistaken and it can draw up quickly [there is nothing and].

[0052] Next, an example of the adjustment of the desired value of the desired value storing section 12 based on the contents of deliberation between persons in charge by the communication Management Department 11 or the warning process of mismatching is explained using drawing 13 . When the trouble which checks advance while a project is going on occurs, the cure is implemented immediately and it must be made not to have to delay the schedule of a project. However, it is a design section that making the planning correction of the scheduling draws up a cure to being a trial section in the case of this example, a cure is put into activation and a prototype section adds correction to an experimental model. For this reason, when a problem occurs, in order for a trial section to plan a retest day, it is necessary to get to know the schedule of a design and a prototype section. It is used, also in order the communication Management Department 11 is such and also to promise a term as that the schedule of a section is got to know based on the schedule. Drawing 13 is drawing for explaining the scheduled input for it. Drawing 13 shows the screen which inputs the convention about an item 4. If an item 4 is chosen on the schedule display screen shown in drawing 11 , a window as shown in drawing will be displayed, and the trouble display column 1301 and the operation cure column 1302 to the trouble are displayed first. Then, a user inputs a convention schedule into the column of the section to which he corresponds, respectively. If an example is given, the design-change schedule column 1303, the design-change termination column 1304, and the column 1305 wishing reconstruction will be inputted in a design section, and will input the reconstruction convention column 1306, the reconstruction implementation column 1307, and the column 1308 wishing test in a prototype section. The trial section which draws up a trial schedule can carry out the re-schedule of the trial schedule with reference to the convention term on this window. According to this system, even if a person in charge is absent by telephone etc. at the time of an inquiry, the data which the person in charge inputted can be referred to. Even if it passed over the date entered in the design-change schedule column 1303, when the date was not inputted into the design-change termination column 1304, as it was monitoring continuously the value of the design-change schedule column 1303 into which a design section inputs a system here, and the design-change termination column 1304, and it judges that it has passed over a term, a system generates warning and it explained above, the carbon button of the corresponding design section becomes red, and it blinks. Moreover, when delay is in a term also like the reconstruction convention column 1306 and the reconstruction implementation column 1307 of a prototype section, actuation which generates warning is carried out. Thus, when a system carries out term management automatically and generates warning, it is effective in the ability to make delay of schedule progress into minimum.

[0053] Although the function and use gestalt of this invention in the case of furthering development were shown managing a schedule above next, the case where development is furthered is explained managing the cost price.

[0054] First, plan / design charge of a new product defines the target cost of a new product from commercial-scene information etc. As shown in drawing 3 , the desired-value assignment section 13 has the cost allotment section 300 which assigns cost desired value to each unit which is the configuration unit of a product, the engine-performance allotment section 310 which performs allotment of the engine performance, and the schedule allotment section 320 which performs allotment of a schedule, and the cost assignment section 300 assigns this target cost to each unit which constitutes a product, and it sets the cost desired value of each unit as the desired-value storing section 12.

[0055] As shown in drawing 3 , the cost assignment section 300 is equipped with allocation-of-cost 302 module which performs the allocation of cost for every unit using the function of the cost-analysis module 301 which inputs the existing reference model information 330 and analyzes the cost structure according to unit of a reference model, and the cost structure according to process, the cost simulation module 303 which inputs the cost reference-value information 340, such as production quantity and a raw-material labor cost, and carries out simulation of the relation of the cost of product to these, and a cost-analysis module and a cost simulation module.

[0056] In addition, it is desirable for the desired value assignment section 13 to be made to carry out a cost assignment, automatic not performing a cost assignment altogether but receiving the interactive directions from plan / design person in charge suitably. Now, since a cost assignment here is the time of development, it is not assigned to components each and assigned the block of the components which constitute a product, and according to main units. Next, as shown in drawing 4 , the development member details the design.
[0057] For example, design persons in charge, such as machine electrical and electric equipment, are 400 which designs its part in its duty shown with a development activity model, and is stored in the product model storing section 2 by using a design result as a structure model and an attribute model.
[0058] It is 402 which the cost presumption section 5 presumes the cost price from this model, and stores 401 and cost estimate in the estimate storing section 8. Estimate and the desired value review section 9 compare this cost estimate with corresponding cost desired value, and each development member enables it to refer to that information result suitably if needed.
[0059] Now, the part by which cost presumption was carried out, and the unit to which cost desired value is set do not correspond at this time. When the part by which cost presumption was carried out is a part of unit to which cost desired value is set, estimate and the desired value review section 9 Cost desired value is divided into the part by which cost presumption was carried out, and the part by which cost presumption is not carried out, and the value which lengthened the value by which cost presumption was carried out from the cost desired value of the whole unit is stored as a target cost of the remaining part.
[0060] Now, when the cost estimate of each unit to which it carried out in this way, the design progressed to, and cost desired value was set can be found and the cost estimate which was able to be found exceeds cost desired value, estimate and the desired value review section 9 are 405 which tells this information to a development member and requires a cure.
[0061] As a cure, the design of the part having exceeded cost desired value is changed, and there are an approach of making a presumed cost low and the approach of raising the target cost of this part according to cost estimate.
[0062] When based on the latter approach, the sum total of the whole cost target and the cost target of a part stops however, being in agreement. Then, the whole and the partial adjustment maintenance section 10 detect this, tells this information to a development member, and requires a cure.
[0063] In addition, there are an approach of lowering the cost desired value of other parts and attaining the whole cost desired value as this cure, and a method of changing the whole cost desired value. This decision is based on the deliberations 407 of each development member, or decision of a development person in charge. The communication Management Department 11 is 406 which grasps these discussed contents and sets that result as the desired value storing section 12.
[0064] Thus, the result discussed and judged is reflected in the desired value storing section 12, and the whole and the partial adjustment maintenance section 10 evaluate the reflected contents. And since the information is told to a development member when there is mismatching of estimate, desired value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.
[0065] Hereafter, furthering-development actuation is explained, managing the target engine performance.
[0066] The engine-performance assignment section 310 in the desired value assignment section 13 sets the performance-objective value at the time of development initiation as the desired value storing section first like [management of the engine performance] cost control. This desired value setup is performed, when plan / design charge of a new product assigns the property of the conventional reference model, and the product property that input the experimental result about a development model, refer to this, and it is related, from commercial-scene information etc. so that the engine-performance assignment section 310 may satisfy this target engine performance by defining the target engine performance of a new product.
[0067] For example, when an air-conditioner is considered as a product and cooling capacity and the

noise are considered as engine performance, as a property related to cooling capacity, there is a property of the property and compressor of a heat exchanger, or a fan, and there are a fan's ventilation sound, an oscillating sound of a case, an operation sound of a motor, etc. as a property about the noise. In this case, the engine-performance assignment section inputs the experimental result about the conventional property of a reference model and a conventional development model, and defines the noise desired value allowed this by reference from the whole noise target at a ventilation sound, an oscillating sound, and an operation sound.

[0068] Next, using this performance-objective value, the development member details the design, as shown in drawing 5 .

[0069] That is, for example, design persons in charge, such as machine electrical and electric equipment, are 501 which designs its part in its duty shown with a development activity model, and is stored in the product model storing section 2 by using a design result as a property model. It is 503 which the engine-performance presumption section 5 presumes the engine performance from this model, and stores 502 and engine-performance estimate in the estimate storing section 8.

[0070] This engine-performance presumption is performed by approaches, such as the so-called simulation and presumption based on the test data of the experimental model presumed and developed from the conventional track record data. Since presumed precision differs greatly, it is made to store in engine-performance estimate here also including the presumed approach by the result of having manufactured and examined the experimental model with presumption from simulation or the conventional track record data.

[0071] Estimate and the desired value review section 9 compare engine-performance estimate with the performance-objective value corresponding to it, and a development member enables it to refer to 504 and its information.

[0072] Thus, it is 505 which estimate and the desired value review section 9 tell this information to a development member when it becomes clear that engine-performance estimate (the engine-performance achievement value by trial is included) cannot attain a performance-objective value, as a result of a design progressing, and requires a cure.

[0073] There are an approach of changing as a cure the design of the part which cannot attain a performance-objective value, and a method of dropping the target engine performance of this part according to engine-performance estimate. In the case of the latter, deliberations of a development member or decision of a development person in charge is needed. The communication Management Department 11 is 506 which grasps these discussed contents and sets that result as the desired value storing section 12.

[0074] Thus, the result discussed and judged is reflected in the desired value storing section 12, and the whole and the partial adjustment maintenance section 10 evaluate the reflected contents. And since the information is told to a development member when there is mismatching of estimate, desired value or the desired value of each part, and the whole desired value, it is not left by the condition of mismatching.

[0075] Next, the actuation which makes circumstantiation and modification of a development activity model with advance of development is explained.

[0076] The development activity model used as the model to which it is indicated that the outline stated previously at the beginning of development is detailed gradually.

[0077] The activity of this circumstantiation can be done as follows.

[0078] For example, in order the result of mechanical layout design is needed in order to carry out an electric packaging design, or to determine a detailed design parameter, when the result of the characteristic test about the design specification is needed, needing the result of other business often arises in the process in which each development member performs business of its part in its duty shown with a development activity model. If these activities are described as an activity unit in a development activity model, this development member does not understand it like the result of that activity, or a working day at development members other than the person in charge of that activity unit, when that activity is a part of activity unit described by the development activity model, although it can refer to

like that activity result and working day.
[0079] In such a case, a development member is 701 which asks the person in charge of an activity who wants to know a detail, i.e., the person in charge of an activity unit including an activity, the result and schedule of an activity as shown in drawing 7 . Such a question is realizable by sending the electronic mail of the defined format 703 to the person in charge of a question place. The reply 702 to this question is similarly performed by the electronic mail. Since the code which identifies the person in charge in charge of the activity is prepared and each development member can refer to a development activity model per activity here as previously shown in drawing 2 , the reference about each activity unit can be recognized mutually, and it becomes possible to send an electronic mail which was described previously.
[0080] Now, the communication Management Department 11 is 704 which sets the new desired value which managed the contents of the question 701 and reply 702 by such electronic mail, and was not set up till then according to the contents of the reply as the desired value storing section 12, or sets a new development activity unit as 705 and the development activity model storing section 3.
[0081] As an example set up as new desired value, there are the detailed schedule items of an activity, the cost price, the desired value items of the engine performance, etc. it was decided that only the schedule of an outline would be, for example.
[0082] Moreover, the development activities for acquiring the desired value set up here will newly be described by the development activity model as one activity unit.
[0083] Thus, by carrying out the question and reply about the business he wants to know a development member mutually, a development activity model and desired value can be detailed and it can go.
[0084] In addition, the person in charge in charge of the activity unit which becomes origin makes the circumstantiation and modification of each activity unit in a development activity model. Modification of the person in charge in charge is possible. Moreover, the code which identifies the person in charge who set the contents as each item which constitutes a model also about a product model and a resource model is prepared, and reference and management of writing are performed to each person in charge person.
[0085] As explained above, while according to this example storing in the product model storing section the product model expressing the structure and the property of the product which each development person in charge takes charge of and which was designed for every part and presuming the engine performance and the cost price of a product from this product model, a schedule is presumed from the development rating and the development resource of each part, this partial advance predicted value is totaled and the advance predicted value to the whole product development is calculated. Each person in charge person can share the advance predicted value of the whole development which changes with progress of development by this. And the plan of development activities can be adjusted so that a target can be attained for this whole and a partial advance predicted value as compared with desired value. Moreover, when a development person in charge corrects or details the target and schedule of an activity relevant to mutual automatically from the information on the communication which carries out a question and a reply mutually, the newest desired value can always be held and each person in charge person can be shown.
[0086] Therefore, detailing with development planning for which the detail has not opted in the beginning of development to progress of development, each person in charge person of a product development can maintain the adjustment of the whole advance predicted-value part obtained from a design result objective, and can form the optimal plan for target achievement.
[0087] Next, the communication Management Department 11 does monitoring of the information transmitted among persons in charge, and shows the processing which sets up automatically the track record information on the development activity model storing section 3, and the desired value of the desired value storing section 12.
[0088] The communication Management Department 11 of this example The status-control item storing section 1401 which stores the status-control item made into the index of the status control defined beforehand as shown in drawing 14 , The fixed form electronic mail collection section 1402 which

collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development, The status-control information monitoring section 1403 which extracts the information about the above-mentioned status-control item included in the collected electronic mail, The status-control information storing section 1404 which stores the extracted information as status-control information, It has the status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section, and the I/O section (not shown) which displays a processing result while receiving the actuation from the outside.
[0089] There are a status-control item about structure about each part article which constitutes the product or it which it is going to develop as a status-control item used as the index of the progress memorized by the status-control item storing section 1401, and a status-control item about the function. As a status-control item about structure, the start date of a design drawing and a completion date, the request day of the estimate based on the drawing, and its return date are used, for example.
[0090] Moreover, as a status-control item about a function, a date of acquisition can be used as a result of the examination opening day of the engine performance to demand and a decision day, a prototype directions day and a date of payment, and the opening day of a functional experiment, for example. Here, the status-control item about a function shows the degree of the achievement about the functional characteristic which it is going to attain rather than shows progress of development directly.
[0091] With input units (un-illustrating), such as a keyboard, the status-control item memorized by the status-control item storing section 1401 receives the actuation from the outside, and has composition which can perform addition or deletion.
[0092] The status-control information storing section 1404 memorizes the status-control information (date etc.) which is the concrete contents of the information about each status-control item memorized by the status-control item storing section 1401.
[0093] With input units (un-illustrating), such as a keyboard, the status-control information-reference section 1405 receives the directions from the outside, and displays the status-control information memorized by the status-control information storing section 1404 through output units (un-illustrating), such as CRT, corresponding to the directions.
[0094] The communication Management Department 11 of this example can be realized by computer which specifically has the information processor equipped with CPU and memory, and an I/O device equipped with CRT and a keyboard.
[0095] the development tools 101, 102, and 103 of the person in charge of the section which the communication Management Department 11 of this example requires for development by the information networks 104, such as LAN (Local Area Network), -- it connects with ...
[0096] the person in charge start to each development -- development tools 101, 102, and 103 -- while performing business concerning development using the processing terminal of ..., for example, a CAD (Computer Assisted Design) tool and operating information, operating communication like a required estimated request and reply communication, order arrangements directions, delivery communication and prototype manufacture directions, and manufacture track record communication in each one of business is carried out. Here, although the person in charge concerning development considers as the development person in charge who develops a product mainly, the person in charge of this invention may not be limited to this, for example, other persons in charge of the administration are satisfactory for him.
[0097] In this invention, it is considering as the configuration performed using the fixed-form-ized electronic mail about operating communication which includes the information about the above-mentioned status-control item among such operating communication. in addition -- an information network 104 -- not necessarily -- a development tool 101 ... does not need to be connected and you may be the configuration that the input/output terminal of the above-mentioned fixed form electronic mail is connected, instead of a development tool.
[0098] According to the configuration of the communication Management Department 11 of this example, the progress situation of development can be grasped by carrying out the monitor of the information about the status-control item which is included in the fixed form electronic mail and which

was defined beforehand in the fixed form electronic mail collection section 1402 and the status-control information monitoring section 1403. Below, a more concrete example is given and explained.
[0099] In this example, the concrete example using the status-control information which is the information about the status-control item about the structure of a development product is explained using drawing 15 . Here, the product structure tree in which the configuration of a product is shown shall be used for the status-control information storing section 1404 as one gestalt which memorizes status-control information. The hierarchical relationship of the whole product, a module, and components is shown, and this product structure tree is usually the same structure as fundamentally as the data called a product structure tree.
[0100] The description of the product structure tree in this status-control information storing section 1404 As information on the node of a tree, as shown in drawing 15 , it adds to the usual design drawing data. The information (for example, processing time) which shows the progress about an estimated request, a reply and order arrangements directions, delivery and prototype manufacture directions, and processing like a manufacture track record as information about a status-control item It is in making it correspond to the column of the progress attribute established for every each part article prepared beforehand with each drawing, and storing in it.
[0101] The information about the above-mentioned status-control item is extracted from the fixed-form-ized electronic mail which is used in case each person in charge persons, such as a design, materials, and a manufacturing department, do operating communication about development, and is stored in the column of the progress attribute which shows the progress situation of the components which constitute a product structure tree.
[0102] For example, if the estimated request to the components which the design section person in charge designed is performed using the fixed form electronic mail 211 to the Supplies Department gate person in charge, the mails 211 will be collected by the fixed form electronic mail collection section 1402. A postscript is carried out about the concrete approach of collection of an electronic mail. The monitor of the information 203 on the collected electronic mail 211 is carried out by the status-control information monitoring section 1403, and it is stored in the column of the estimated request of components which the time of the date of issue of the mail 211 makes the object in the status-control information storing section 1404.
[0103] Moreover, when the Supplies Department gate person in charge who received this estimated request electronic mail 211 estimates and a reply is performed using the fixed form electronic mail 212, the monitor of that mail 212 is carried out by the status-control information monitoring section 1403, and the time of the date of issue contained in the information 204 on that estimated reply electronic mail 212 is stored in the column of the estimated reply of components made into the object in the status-control information storing section 1404.
[0104] Although the above shows an estimated request of the components of the product currently developed, and processing of registration of the time to the column of a reply The order arrangements directions day and the date of payment, prototype directions day, and manufacture completing date of a configuration member of each part article It is stored in the predetermined column of the status-control information storing section 1404 by carrying out the monitor of the above-mentioned information and the information 205, 206, 207, and 208 similarly included in each of the fixed-form-ized electronic mails 213, 214, 215, and 216, respectively.
[0105] Moreover, it is good also as a configuration which registers information like the estimated conditions for example, in an estimated request, and the estimated amount of money in an estimated reply besides the time which is the status-control information shown in drawing 15 . When referring to progress, such information is effective in order to grasp not only time but the contents of progress.
[0106] 1 which shows development progress of each module of the product developed, or components if the above configurations are used -- when -- drawing creation -- starting -- 2 -- when -- a drawing -- completing -- 3 -- when -- estimating -- requesting -- 4 -- when -- an estimated reply -- coming out -- 5 -- order arrangements are carried out when -- having -- 6 -- it supplies when -- having -- 7 -- prototype directions are carried out when -- having -- 8 -- it can grasp [when it was manufactured and].

[0107] The example in the case of displaying the status-control information stored in the status-control information storing section 1404 by the status-control information-reference section 1405 is shown in drawing 16 . As a transcription of progress, there are a time display format (drawing 16 (1)) and a graphical display format (drawing 16 (2)), for example.
[0108] According to a time display format, as shown in drawing 16 (1), a tabular format shows the time 1601 by which the nomenclature 1610 which constitutes the product currently developed and the time about status-control information, i.e., the engineering-drawing plot start date 1611 - the manufacture completing date 1618, and the present time, and these status-controls information were updated to the output screen 1600 of the output unit of this example. Moreover, a non-started thing is a blank among the above-mentioned status-control information, and what was carried out displays the time.
[0109] In this Fig., about the cabinet 1602 which is one of the component parts of the product currently developed, although the estimated request day 1603 is on January 15, the reply 1604 to it shows the condition of not being obtained, for example.
[0110] In the graphical display format, as shown in drawing 16 (2), in order to show that the processing corresponding to the above-mentioned status-control information 1611-1618 was completed, the specific marks 1621-1628 by the color, patterns, or those combination are decided for every information.
[0111] In addition, the above-mentioned status-control item is an index which shows the progress situation of a product directly. That is, for example, whenever it decides on every one time of the above-mentioned status-control item in drawing 16 (1), it is shown that development of a product is progressing. For this reason, below, the processing corresponding to each of the above-mentioned status-control item is called the progress step in development.
[0112] The graphical display format shows further the progress situation of the module of each node, or components in the progress steps (processing corresponding to the above-mentioned status-control item) 1611-1618, and the bill-of-materials tree expressed using correspondence relation with the marks 1621-1628 assigned for every progress step, and the mark determined with this correspondence relation to the output screen 1600. Drawing 16 (2) expresses the same thing as the progress situation shown in drawing 16 (1) as the mark which was able to be decided the account of a top.
[0113] although strict time is not known in this graphical display format, there is goodness that, for example, a whole situation can grasp the color used for a mark at a glance by making it deep according to advance of a progress situation since it is thin.
[0114] Moreover, although an indication is given about the processing performed at the time newest stage in this example, it is good also as a format similarly expressed about all processings performed until now using a mark, for example.
[0115] Next, an operation of this example is explained using drawing 17 , drawing 18 , drawing 19 , and drawing 20 .
[0116] In this example, the fixed form electronic mail collection section 1412 collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development. The fixed form electronic mail collection section 1412 is taken as a configuration equipped with the mail server 1801 which performs collection of an electronic mail, issue, etc., as shown in drawing 18 .
[0117] The fixed form electronic mail in this example can fixed-form-ize the contents with the class, the time, and the contents attribute of e-mail, as shown in drawing 19 . Here, the class of e-mail corresponds to the status-control item stored in the status-control item storing section 1401, and has the request-for-quotation mail 211 and estimated reply mail 212 grade. Time shows the date of issue of e-mail. A contents attribute corresponds to the class of the mail, and a request-for-quotation number and the estimated amount of money are contained as a contents attribute of the estimated reply mail 212.
[0118] Such a fixed form electronic mail can be created and transmitted by performing actuation of following the flow chart shown in drawing 20 in an electronic mail transmit terminal equipped with the actuation screen 1700 as shown in drawing 17 .
[0119] That is, the class of electronic mail which it is going to send is first chosen from a menu 1701 (step 1201). Here, the class of selectable mail is determined that it will correspond to the status-control item memorized by the status-control item storing section 1, uses the class of mail as shown in drawing

6 as a selection branch, and sets it up.
[0120] Next, the contents attribute corresponding to the class of selected mail is inputted (step 1202). By drawing 17 , to the class "an estimated request" of mail chosen with the menu 1701, the input column 1702 of a contents attribute "drawing-for-estimate watch" required for it is displayed, and the condition that information required for it is inputted is shown. The contents attribute inputted at this step corresponds to the class of mail chosen at the above-mentioned step, and, specifically, is information as shown in the column of the contents attribute of drawing 19 .
[0121] Finally, the transmission place of e-mail is chosen from a menu 1703 (step 1203). Here, as a transmission place, the section related to development shall be included at least. In the e-mail sentence 1704 created as mentioned above, information about the date of issue and the section of a publishing agency is added and published further.
[0122] In this example, although an example of the approach of carrying out creation issue of the fixed form electronic mail using a menu was explained, if an electronic mail including information which was illustrated by drawing 19 can be created, in this invention, the concrete configuration of the creation approach or listing device will not be limited.
[0123] The fixed form electronic mails which were created in each section as mentioned above, and were published are once collected by the mail server 1801 of the fixed form electronic mail collection section 1402, as shown in drawing 18 . Next, the status-control information monitoring section 1403 chooses an electronic mail including the information about the status-control item stored in the status-control item storing section 1401 among the they-collected fixed form electronic mails, extracts the information concerned from the selected electronic mail, and the status-control information storing section 1404 is made to memorize it.
[0124] According to the flow chart shown in drawing 18 , the status-control information monitoring section 1403 reads an electronic mail from a mail server 1801 at first (step 1811), and, specifically, the class of read electronic mail is extracted (step 1812).
[0125] Next, it investigates whether it corresponds to mail of the format that the class of extracted electronic mail contains one of the status-control items 1802 defined by the status-control item storing section 1401 (step 1813). If it does not correspond to mail of the format containing one of the status-control items 1802 (it is No at step 1813), nothing is processed but it considers as termination.
[0126] When it corresponds, Yes), and the date and contents attribute of this mail are taken out at the (step 1813 (steps 1814 and 1815), they are stored in the predetermined progress attribute column of the status-control information storing section 1404 (step 1816), and processing is ended.
[0127] Whenever it comes to a mail server 1801, it performs, or there is an approach a new electronic mail checks new mail of a mail server 1801 periodically as an approach of starting processing of the above status-control information monitoring sections 1403.
[0128] Moreover, it is good also as a configuration to which the status-control information monitoring section 1403 is set with one of the transmission places of e-mail, and all electronic mails are automatically transmitted by the status-control information monitoring section 1403. According to such a configuration, the status-control information monitoring section 1403 can receive an electronic mail, without minding the fixed form electronic mail collection section 1402.
[0129] Processing of the electronic mail by the status-control information monitoring section 1403 which was illustrated in the above-mentioned example is realized by fixed-form-izing the format of the message contained in an electronic mail like an e-mail class, time, and a contents attribute.
[0130] Next, in this example, the concrete example using the information about the status-control item about the function of a development product is explained using drawing 21 . Here, as one gestalt which memorizes a status-control item, the information which shows the whole product or the operation result of count of the property of a part or an experiment is stored in the status-control information storing section 1404 at the functional attribute column 2100 so that the progress situation about the function of a product can be expressed.
[0131] In development of a product, count conditions and the count approach are changed, multiple-times operation may be carried out, the experiment about a functional characteristic also changes

experiment conditions and the target experimental model, and multiple-times operation of the count of the functional characteristic of a product may be carried out. The experiment about the computation of such a functional characteristic or a functional characteristic has many which are beforehand defined corresponding to categories, such as a form of a product.
[0132] Therefore, whenever [whenever / achievement / to the function of the product currently developed], i.e., the progress situation in the functional whole surface of development, can be measured by carrying out monitoring of these computations and experiment processings. For this reason, in this example, the functional attribute column 2100 which stores the operation result of count of a property or an experiment has the tabular format which can store the operation result of multiple times about the functional characteristic which it is going to search for.
[0133] The contents of the information stored in the functional attribute column 2100 are extracted from the fixed-form-ized electronic mail which is used in case each person in charge persons, such as a design, analysis, and a trial section, do operating communication about a development test, and are stored.
[0134] For example, if a request of the count about the functional characteristic over the components which the design section person in charge designed is performed using the fixed form electronic mail 2111 to an analysis section person in charge, the mails 2111 will be collected by the fixed form electronic mail collection section 1402. The monitor of the information 2101 on the collected electronic mail 2111 is carried out by the status-control information monitoring section 1403, and it is stored in the column of the count conditions of the functional characteristic which the count conditions of the mail 2111 make the object in the status-control information storing section 1404.
[0135] Moreover, when the analysis section person in charge who received this property count request electronic mail 2111 performs a property count result using the fixed form electronic mail 2112, the monitor of that mail 2112 is carried out by the status-control information monitoring section 1403, and the count result included in the information 2102 on that mail 2112 is stored in the column of the count result of the functional characteristic made into the object in the status-control information storing section 1404.
[0136] Moreover, the conditions of a functional characteristic experiment and arrangements directions, and a report of an experimental result are also stored in the predetermined column of the status-control information storing section 1404 by carrying out the monitor of the information 2103 and 2104 on the fixed-form-ized electronic mails 2113 and 2114 like the above, respectively.
[0137] Thus, count and an experiment of the whole product or the property of a part are conducted when, and by referring to the functional attribute column 2100 into which information was inputted shows what kind of result was obtained.
[0138] Next, other examples of the development progress monitoring system which applied this invention are explained using drawing 22 . In order to carry out monitoring of the development progress situation about the function of a development product, the information on the count directions to the computer in implementation of count of the functional characteristic of the development product is used for this example.
[0139] the communication Management Department 11 of this example shows drawing 22 -- as -- development tools 101 and 102 -- the information on the count directions sent to a computer 2200 from ... development tools 101 and 102 -- it has the configuration which carries out monitoring through the information network 104 where ... and a computer 2200 are connected.
[0140] The status-control item storing section 1401 which stores the status-control item which this example makes the index of the status control defined beforehand, The count directions monitoring section 1406 which extracts the information about the status-control item included in the count directions information sent to a computer 2200, The status-control information storing section 1404 which stores the extracted information as status-control information, It has the status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section 1404, and the I/O section (not shown) which displays a processing result while receiving the actuation from the outside.

[0141] As a status-control item memorized by the status-control item storing section 1401, the directions information on count about the product or components concerned which are performed by the computer 2200, such as estimated count about a development product or its component part and count of a functional characteristic, can be used, for example.
[0142] Although monitoring of the contents of the electronic mail of operating communication exchanged among the development persons concerned was carried out in the above-mentioned example, monitoring of the information on count directions [instead of an electronic mail] is carried out from the developer to the computer 2200 in this example.
[0143] In the configuration of this example, it does not grind status-control information monitoring section 1403 with the fixed form electronic mail collection section 1402 contained in the above-mentioned example, instead has the count directions monitoring section 1406. It is judged whether it corresponds to the status-control item memorized by the status-control item storing section 1401 like the processing in the above-mentioned example shown in drawing 18 , when it corresponds, the contents are extracted, and the contents of the count directions by which monitoring was carried out are stored in the status-control information storing section 1404.
[0144] Since it is not necessary to prepare the electronic mail collection section according to this example, without collecting and carrying out monitoring of the electronic mail, a system configuration can be simplified more and becomes possible [grasping the development progress situation of the functional characteristic of a product].
[0145] Next, other examples of the development status-control system which applied this invention are explained using drawing 23 .
[0146] This example sets the time of the scheduled completion date of the processing corresponding to each status-control item as the status-control information storing section 1404, and displays the comparison display with a completion schedule and an actual progress situation, and the status-control item delayed for the completion schedule.
[0147] The status-control item storing section 1401 which stores the status-control item made into the index of the progress defined beforehand as this example is shown in drawing 23 , The fixed form electronic mail collection section 1402 which collects the fixed-form-ized electronic mails which are exchanged by section Momma concerning development, The status-control information monitoring section 1403 which extracts the information about the status-control item included in the collected electronic mail, The status-control information storing section 1404 which stores the extracted information as status-control information, The status-control information-reference section 1405 for referring to the status-control information stored in the status-control information storing section 1404, It has the I/O section which displays a processing result while receiving the actuation from the outside, and the status-control information setting section 1407 which sets up the termination scheduled day of the processing corresponding to the above-mentioned status-control item.
[0148] In this example, the configuration and operation of the requirements for a configuration of those other than status-control information setting section 1407 are the same as the example of drawing 14 , and explanation here is omitted.
[0149] In this example, a setup at the time of the termination scheduled day of the processing corresponding to the above-mentioned status-control item by the status-control information setting section 1407 is performed through the display screen 1600 of the output unit of the I/O section as shown in drawing 24 . Scheduled day setting processing of this status-control information setting section 1407 is started by clicking the schedule setup key 2401 prepared on the display screen 1600 with input units, such as a mouse or a keyboard. In addition, drawing 24 shows the condition of the screen 1600 after this scheduled day setting processing was started.
[0150] In Screen 1600 which performs a schedule setup, the name 1610 of the component part of a development product and the processings 1611-1618 corresponding to the above-mentioned status-control item are shown by the tabular format. In order to input the termination scheduled day, an operator specifies the column which is going to input on Screen 1600 with a mouse etc., and inputs the date from a keyboard. The status-control information setting section 1407 accepts these directions, and

sets up the scheduled day for every processing corresponding to the status-control item of each part article.
[0151] Moreover, in a setup of the scheduled day, it is good also as structure where it does not input like this example, respectively, for example, the standard period is beforehand set up for every processing concerned, and the termination scheduled day about the processing after the inputted processing can be set up automatically.
[0152] In this example, the status-control information-reference section 1405 can be started after a scheduled day setup by the status-control information setting section 1407, and displaying collectively the time of the termination scheduled day of the processing corresponding to each status-control item and the actual end date stored in the status-control information storing section 1404 can compare a schedule and an actual progress situation.
[0153] Display processing of the status-control information-reference section 1405 is clicking the progress reference carbon button 2402 prepared in Screen 1600 for setting up the scheduled day shown in drawing 24 , and is started.
[0154] As a display gestalt, there are a time schedule / a track record display format (drawing 25 (1)) which displays a time schedule and a track record by several characters in all, and a graphical display format (drawing 25 (2)) displayed by the mark which defined beforehand whether the actual progress situation would be behind the schedule, for example.
[0155] In addition, drawing 25 (1) and display selection of (2) are performed by clicking either among the time carbon button 2503 newly displayed by clicking the progress reference carbon button 2402 prepared on Screen 1600, and the alarm carbon button 2504.
[0156] In a time schedule / track record display format, as shown in drawing 25 (1), the termination scheduled day 2505 and the actual end date 2506 display collectively to each of the processings 1611-1618 corresponding to a status-control item.
[0157] As shown in drawing 25 (2), a graphical display format expresses by the mark 1105 which changed the color and the pattern, and the mark 1106 so that the difference between the processing corresponding to the status-control item which is behind the schedule, and the processing which is not behind may appear clearly.
[0158] Moreover, it is good also as a configuration which the processing name which combined the transcription by the mark equipped with the color or pattern corresponding to each processing of a status-control item like the graphical display format of this example and the display format of drawing 16 , and is behind the schedule can specify concretely.
[0159] Since according to this example the termination scheduled day can be set up for every corresponding processing with a status-control item and it can be compared with an actual processing date, the progress situation of development can grasp more clearly.
[0160] Next, communication of problem generating performed between a design section and a trial section is explained using drawing 26 . When a problem occurs during a trial in a trial section, it is necessary to connect with a correspondence section immediately. Now, a problem occurs, and when the correspondence section is a machine design section, a trial section must connect immediately the contents of the problem generated during the trial. Since the person in charge of a design section cannot be in a seat in the case of a telephone, communication mail is transmitted using the communication Management Department 11. Drawing 26 is drawing showing an example of the dispatch screen of this communication mail. Drawing 26 is a screen for transmitting the problem generated while the trial section examined. In the problem communication mail dispatch screen 900 of drawing 26 , it has the examiner selection column 901 which chooses an examiner name, and the designer selection column 902 which chooses a designer name. This is the relation between an addresser and the destination as used in the field of common mail. Thus, it can set up by choosing from a menu by scrolling. Suppose that it generated now while the problem "the noise of a motor was loud" examined. Although an examiner sends e-mail immediately when a problem occurs during a trial, the procedure chooses a motor from classification 1 first. This classification 1 list 904 is a category which mainly points out a location and components. When choosing classification 1 list 904, in classification 2 list 903, the class of

measurement value corresponding to the location and components of classification 1 list 904 appears. If a "sound" is chosen here, since the example of the mail which is related to a sound will be displayed on a menu 905, when this message "the noise is loud" is chosen and a dispatch carbon button is pushed, problem communication mail is stored in the problem hysteresis storing section 151 of the informative matter storing section 15 by the communication Management Department 11, and it is transmitted that new mail reached the design. Moreover, the sent mail is displayed on the dispatch hysteresis management display 906 with submission time. Deletion is performed by pushing a deletion carbon button to delete the sent mail from hysteresis, and cancellation of transmitted mail can be performed. [0161] Next, the handling of the above-mentioned communication mail in a design section is explained using drawing 27 and drawing 28 . Its identifier of the designer who received the above-mentioned communication mail is [however] red, and he blinks. [of the menu 2701] This menu 2701 details to people's identifier what divided the user into the trial section with the machine design, the electrical design, and the prototype in the above. Drawing 27 shows that communication mail has reached "Suzuki." At this time, the laboratory name currently used for the laboratory name display 2702 which corresponds if the contents of e-mail are displayed is displayed, the test condition of the trial item which the problem generated is displayed on the condition display 2703, and the problem communication mail with which it was transmitted further is displayed on the communication mail display 2704. Beforehand, since it is stored in the informative matter storing section 15 by the communication Management Department 11, experimental measurement data can display a test data on a screen, if relating of measurement data and problem communication mail is performed. It is drawing 28 which showed the display to the above-mentioned designer. If e-mail is chosen in drawing 27 , as shown in drawing 28 , the graph of measured value can be displayed. The display of this graph graph-izes the data of the parameter name which should be displayed from the correspondence table which described the relation between the measured-value name shown in drawing 29 , and mail. item **** 2902 of drawing 29 -- for example, "motor noise -- it is large -- " -- ** -- it is the part the parameter group which should be displayed to the said problem communication mail is described to be. Thus, when one problem generates the parameter related to a problem class and its problem by using a relating beam table, it is not necessary to consider what kind of measured value should be referred to for cause investigation of the problem, and is effective in the ability to perform cause investigation very efficiently. That is, since a measurement result can be grasped on real time, even if a problem occurs, it has the features that it can shift to cure examination and cure implementation quickly.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the configuration of the development support system concerning one example of this invention.
[Drawing 2] It is the explanatory view showing the configuration of the development activity model which the development support system concerning one example of this invention uses.
[Drawing 3] It is the explanatory view showing the procedure of a setup of development desired value using the development support system concerning one example of this invention.
[Drawing 4] It is the explanatory view showing the procedure of actuation of cost control using the development support system concerning one example of this invention.
[Drawing 5] It is the explanatory view showing the procedure of target engine-performance achievement management using the development support system concerning one example of this invention.
[Drawing 6] It is the explanatory view showing the procedure of target schedule achievement management using the development support system concerning one example of this invention.
[Drawing 7] It is the explanatory view showing the circumstantiation of the development activity model using the development support system concerning one example of this invention, and the procedure of modification.
[Drawing 8] It is an explanatory view explaining the method of termination schedule presumption of this invention.
[Drawing 9] It is the explanatory view showing the example of quantification of whenever [progress / of a project].
[Drawing 10] It is an explanatory view explaining the warning message generation method of this invention.
[Drawing 11] It is drawing showing the example of 1 screen for planning and edit of scheduling.
[Drawing 12] It is an explanatory view for explaining the precedence relation between operation items.
[Drawing 13] It is the explanatory view showing the example of 1 screen for design and prototype / trial section to perform a schedule input mutually.
[Drawing 14] It is the block diagram showing the configuration of the development progress monitoring system concerning one example of this invention.
[Drawing 15] It is the explanatory view showing the example of the approach of carrying out monitoring of the development progress using the status-control information based on the structure of a product.
[Drawing 16] Drawing 16 (1): It is the explanatory view showing the example of the screen which displays a progress situation using status-control information.
Drawing 16 (2): It is the explanatory view showing the example of the screen which displays a progress situation using status-control information.
[Drawing 17] It is the explanatory view showing the example of the actuation screen which creates various fixed form electronic mails.
[Drawing 18] It is the explanatory view showing the processing whose status-control information monitoring section carries out monitoring of the contents of the electronic mail, and registers status-

control information into the status-control information storing section.
[Drawing 19] It is the explanatory view showing the formal example of the message of the fixed form electronic mail which enables the contents interpretation of an electronic mail.
[Drawing 20] It is the flow chart which shows an example of creation processing of a fixed form electronic mail.
[Drawing 21] It is the explanatory view showing the example of the approach of carrying out monitoring of the development progress using the status-control information based on the function of a product.
[Drawing 22] It is the block diagram showing the configuration of the development progress monitoring system concerning other examples of this invention.
[Drawing 23] It is the block diagram showing the configuration of the development progress monitoring system concerning other examples of this invention.
[Drawing 24] It is the explanatory view showing the example of the actuation screen which sets up the time of the termination scheduled day of the processing corresponding to each status-control item.
[Drawing 25] Drawing 25 (1): It is the explanatory view showing the example of the screen which actually displays the comparison with a situation as a termination schedule.
Drawing 25 (2): It is the explanatory view showing the example of the screen which actually displays the comparison with a situation as a termination schedule.
[Drawing 26] It is the explanatory view showing the example of 1 screen of the communication mail dispatch used for communication of the generating trouble under trial.
[Drawing 27] It is drawing showing the example of 1 screen of the communication mail display received during the trial.
[Drawing 28] It is the explanatory view showing the example of 1 screen for communication mail to refer the measurement data under trial.
[Drawing 29] It is drawing showing an example of the relational data structure of problem communication mail and a parameter.
[Description of Notations]
1 .... Model creation section
2 .... Product model storing section
3 .... Development activity model storing section
4 .... Resource model storing section
5 .... Cost presumption section
6 .... Engine-performance presumption section
7 .... Schedule presumption section
8 .... Estimate storing section
9 .... Estimate and the desired value review section
10 .... The whole and the partial adjustment maintenance section
11 .... Communication Management Department
12 .... Desired value storing section
13 .... Desired value assignment section
15 .... Informative matter storing section
1401 .... Status-control item storing section,
1402 .... Fixed form electronic mail collection section,
1403 .... Status-control information monitoring section,
1404 .... Status-control information storing section,
1405 .... Status-control information-reference section,
1406 .... Count directions monitoring section,
1407 .... Status-control information setting section.

[Translation done.]

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DRAWINGS

[Drawing 9]

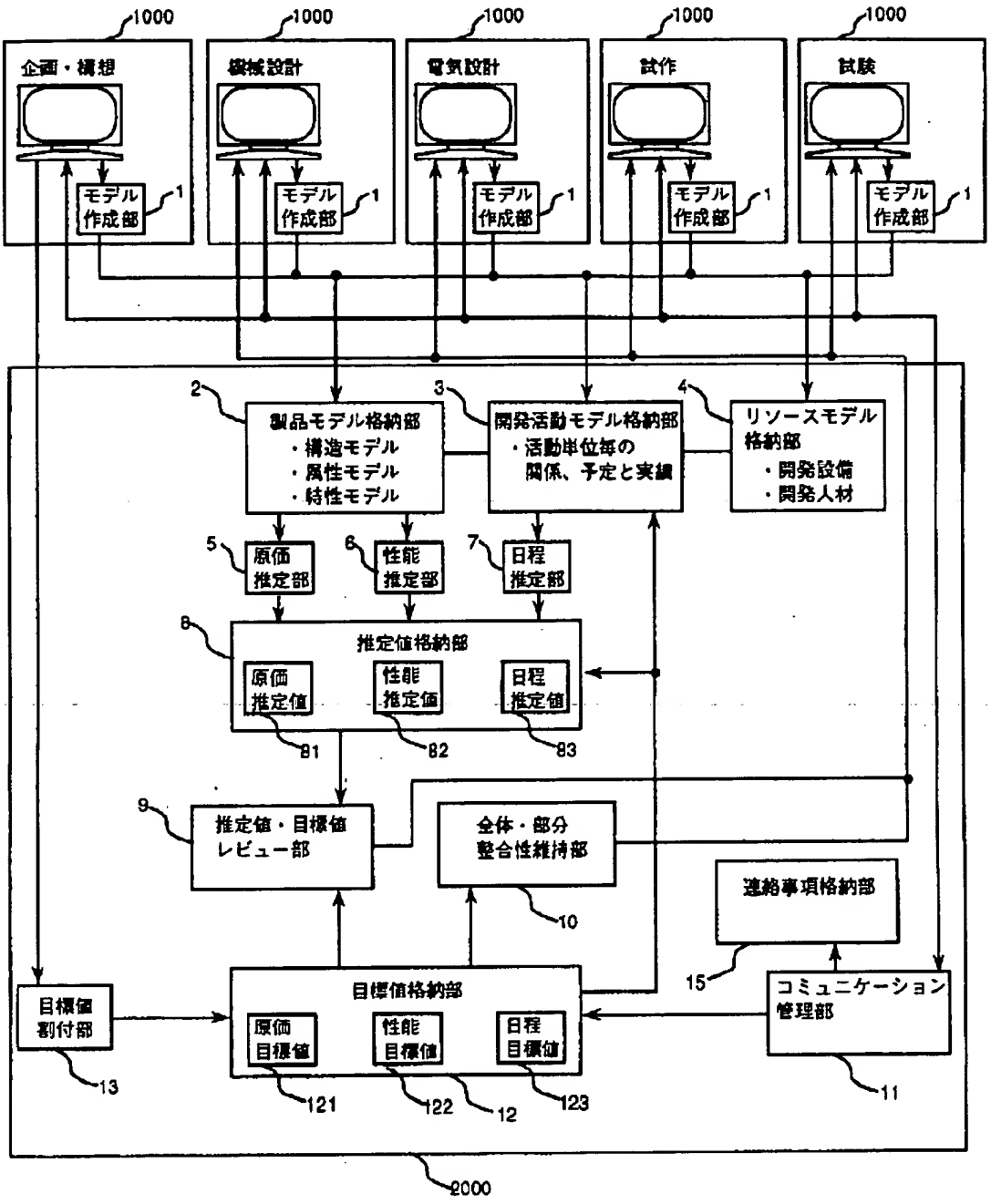
図9

指標1＝（$\frac{\text{全実施項目数}}{\text{終了した実施項目数}}$ −1）×経過工数

指標2＝（$\frac{\text{発生問題数}}{\text{解決問題数}}$ −1）×経過工数

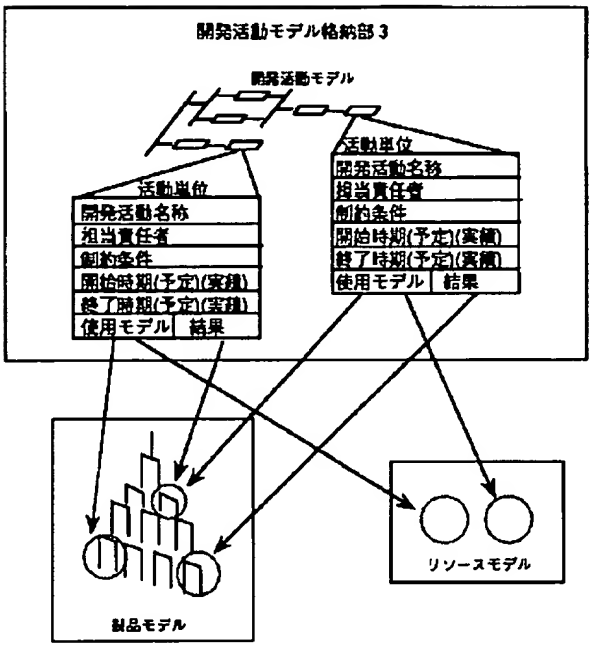
[Drawing 1]

図1


1000
企画・構想
機械設計
電気設計
試作
試験
モデル作成部
1
2
製品モデル格納部
・構造モデル
・属性モデル
・特性モデル
3
開発活動モデル格納部
・活動単位毎の関係、予定と実績
4
リソースモデル格納部
・開発設備
・開発人材
5
原価推定部
6
性能推定部
7
日程推定部
8
推定値格納部
原価推定値
性能推定値
日程推定値
81
82
83
9
推定値・目標値レビュー部
全体・部分整合性維持部
10
連絡事項格納部
15
コミュニケーション管理部
11
目標値割付部
13
目標値格納部
原価目標値
性能目標値
日程目標値
121
122
12
123
2000

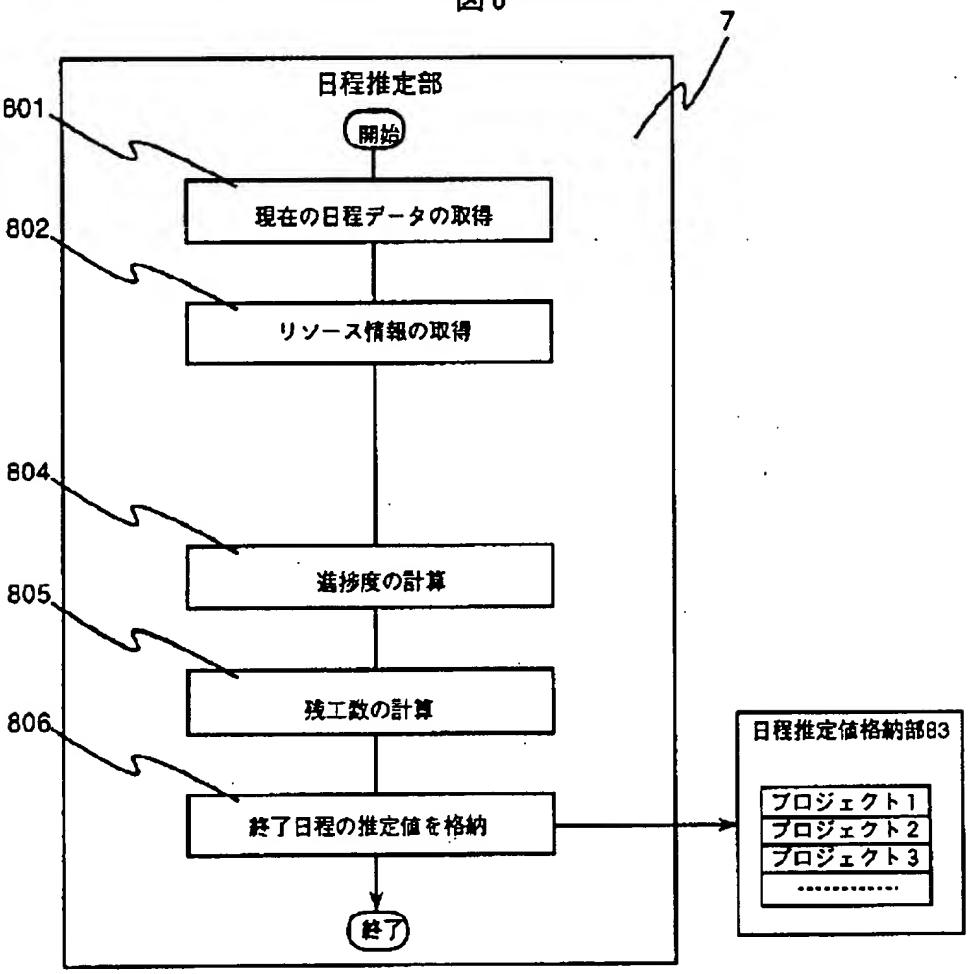
[Drawing 2]

図2



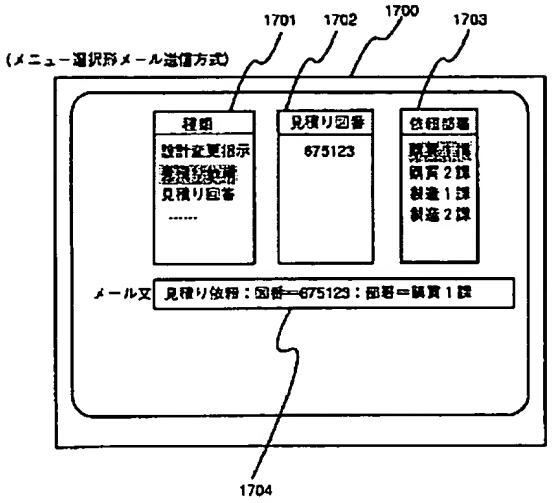
[Drawing 8]

図8



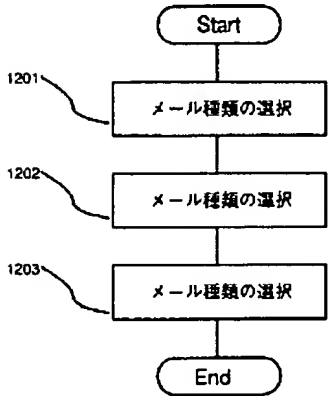
[Drawing 17]

図17



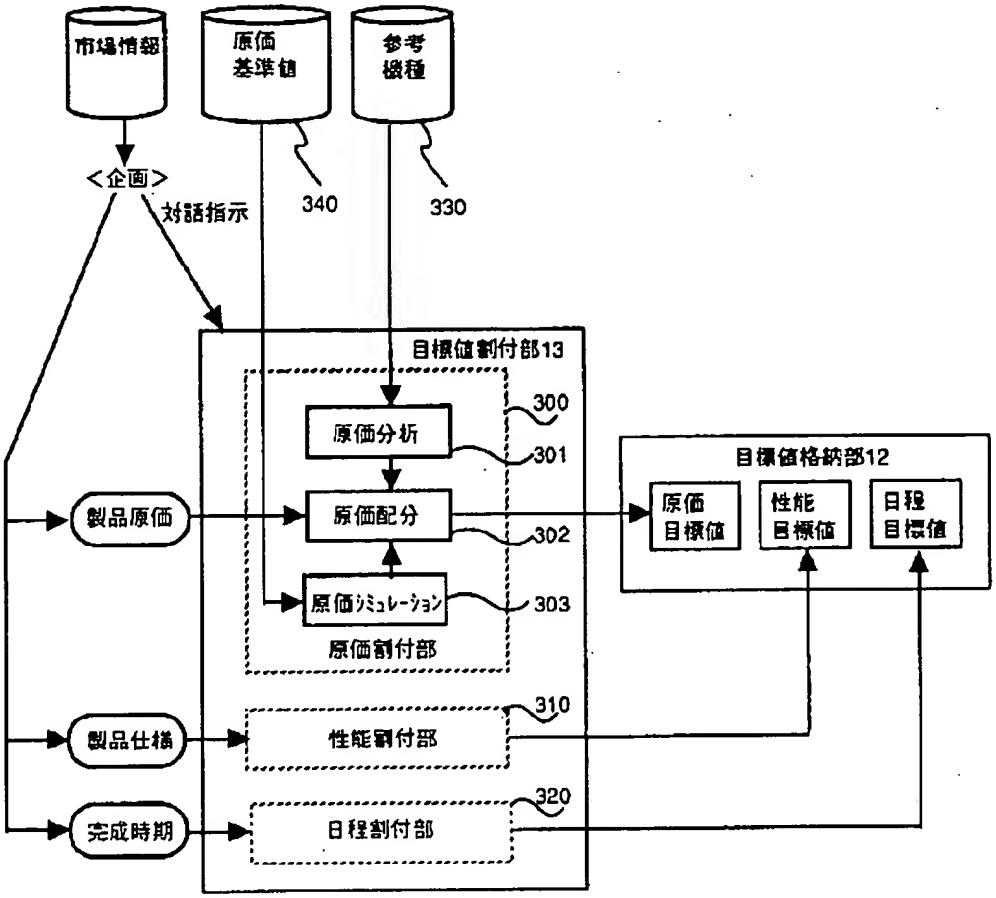
[Drawing 20]

図20



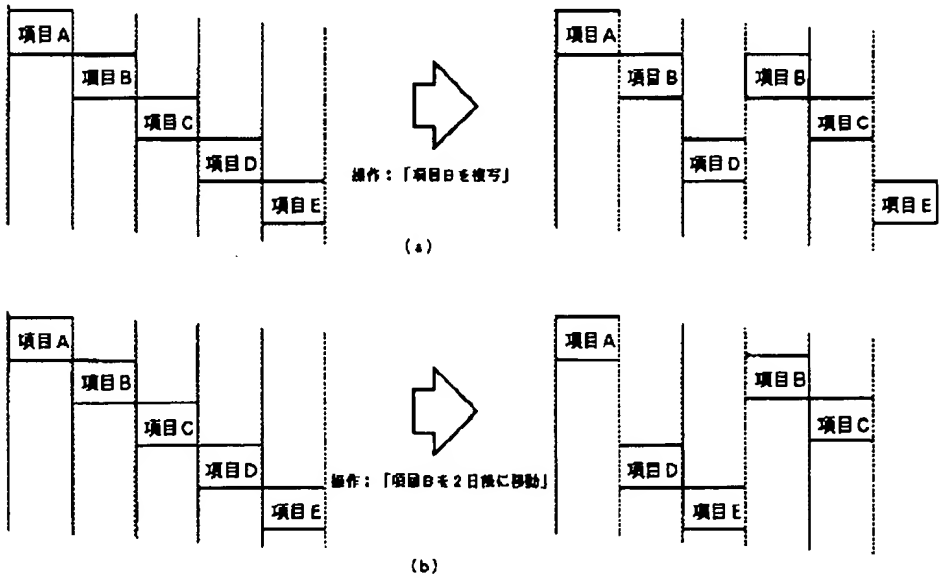
[Drawing 3]

図3



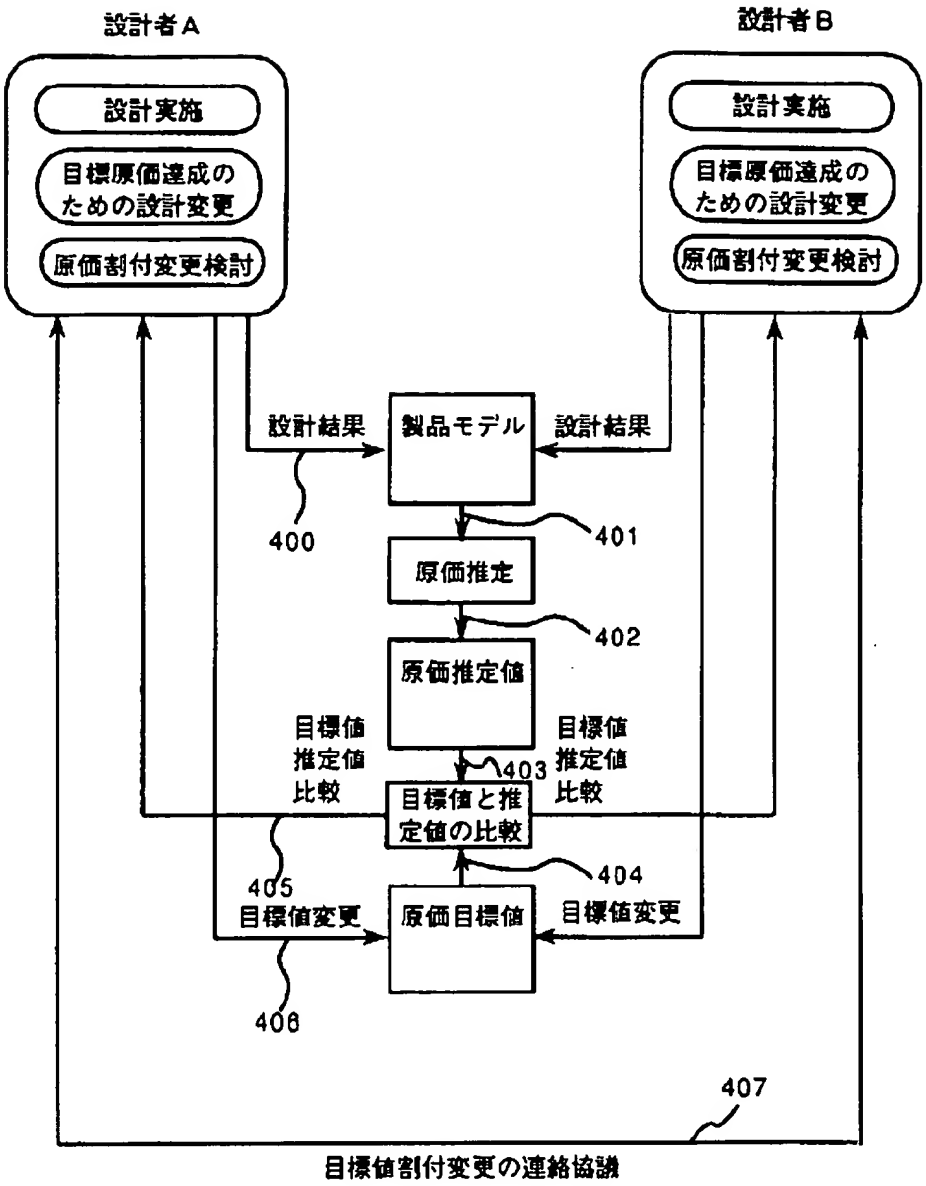
[Drawing 12]

図12



[Drawing 4]

図4


設計者A
設計者B
設計実施
目標原価達成のための設計変更
原価割付変更検討
設計実施
目標原価達成のための設計変更
原価割付変更検討
設計結果
製品モデル
設計結果
400
401
原価推定
402
原価推定値
目標値推定値比較
403
目標値と推定値の比較
目標値推定値比較
405
目標値変更
404
原価目標値
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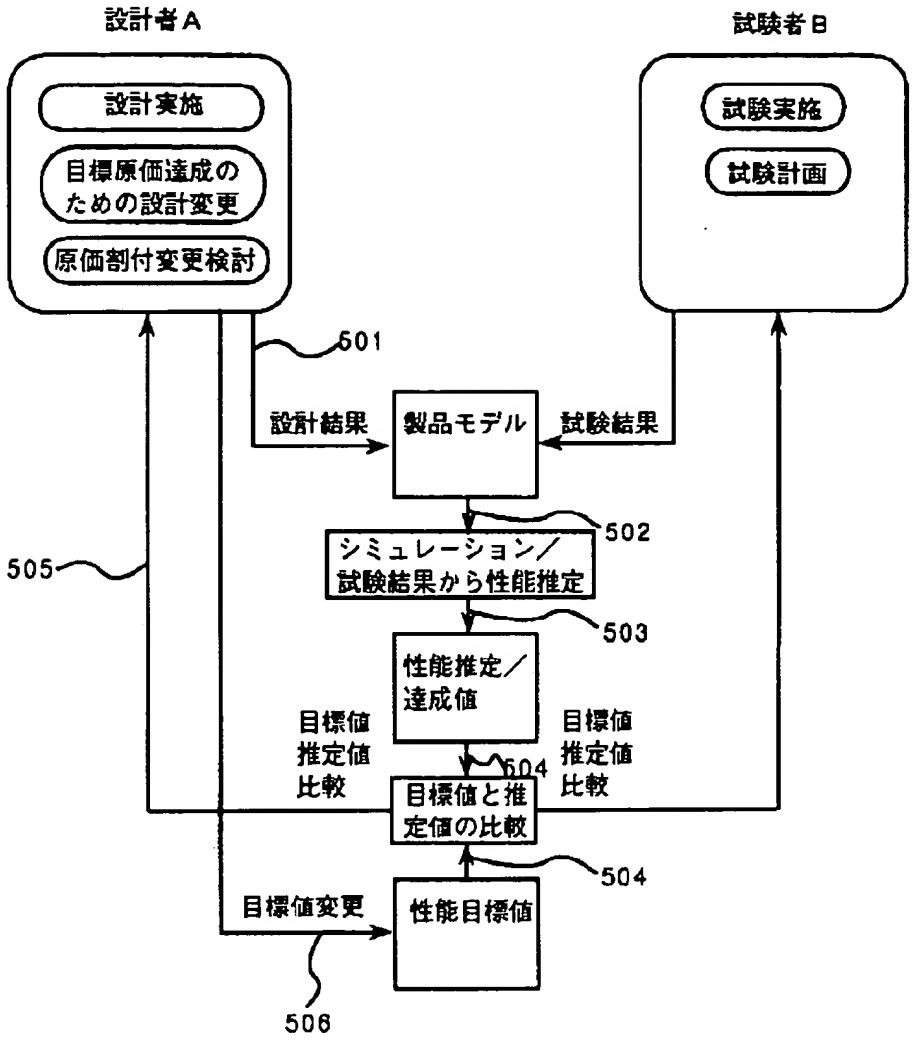
407
目標値割付変更の連絡協議

[Drawing 5]

図5



[Drawing 13]

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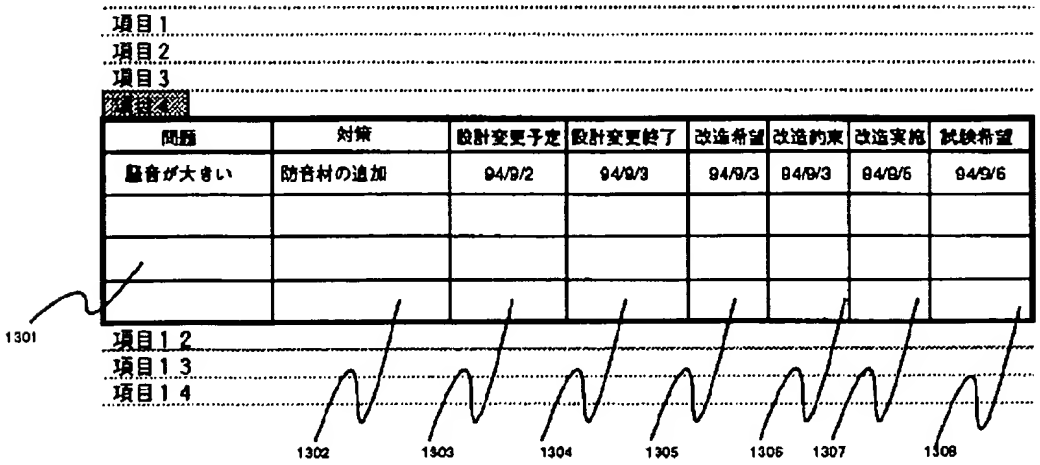

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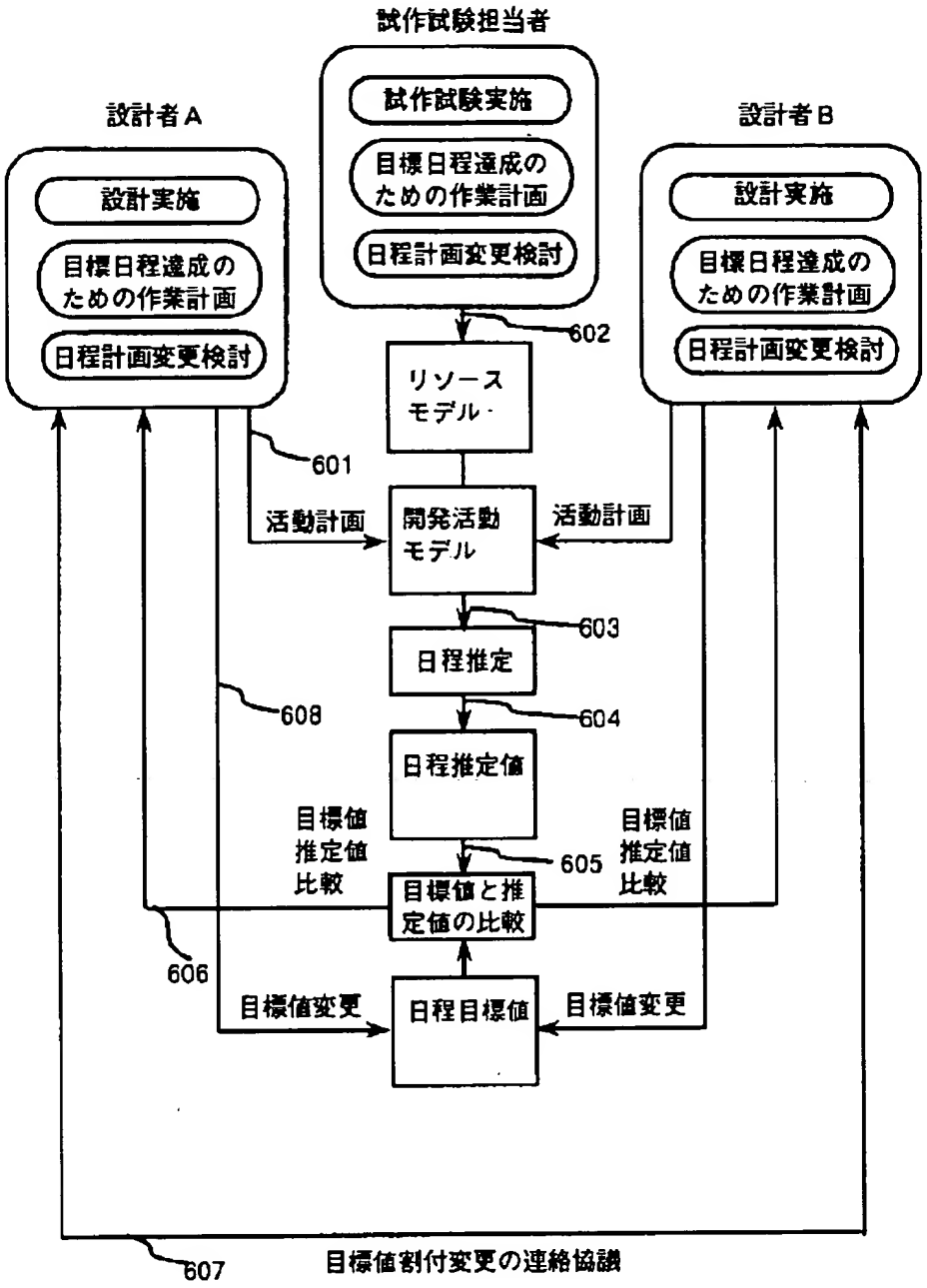
図6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設計実施
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日程計画変更検討
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開発活動モデル
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日程推定
608
604
日程推定値
目標値推定値比較
605
目標値と推定値の比較
目標値推定値比較
606
目標値変更
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607
目標値割付変更の連絡協議

[Drawing 7]

図7

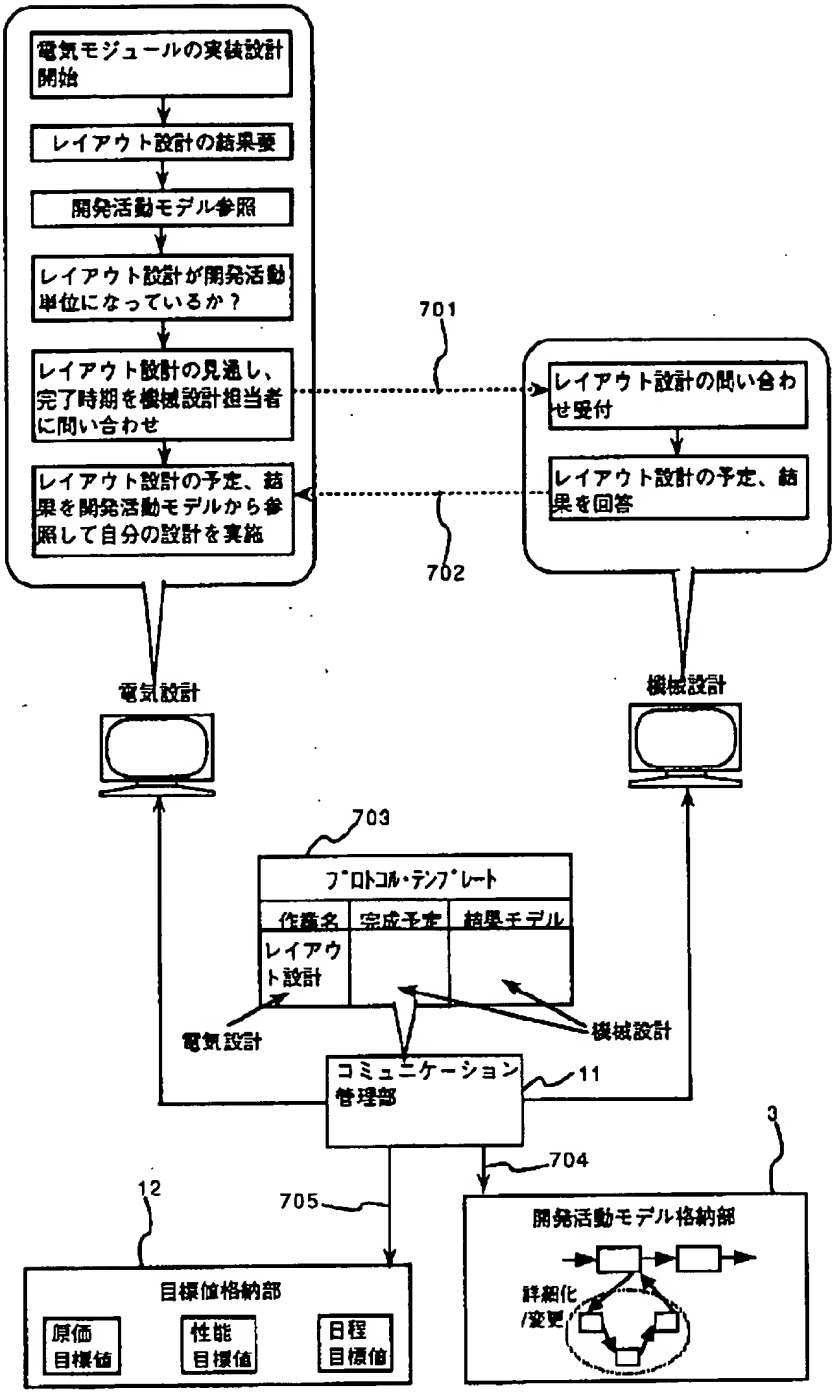

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図10

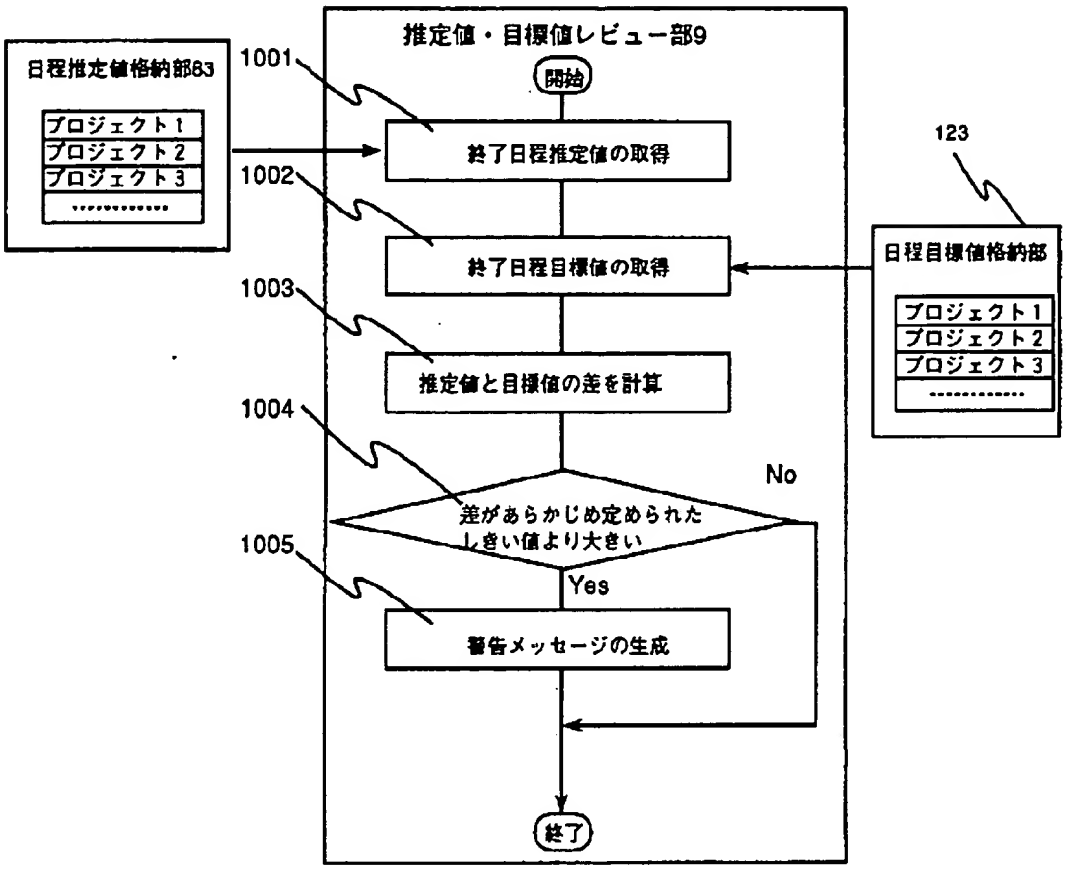

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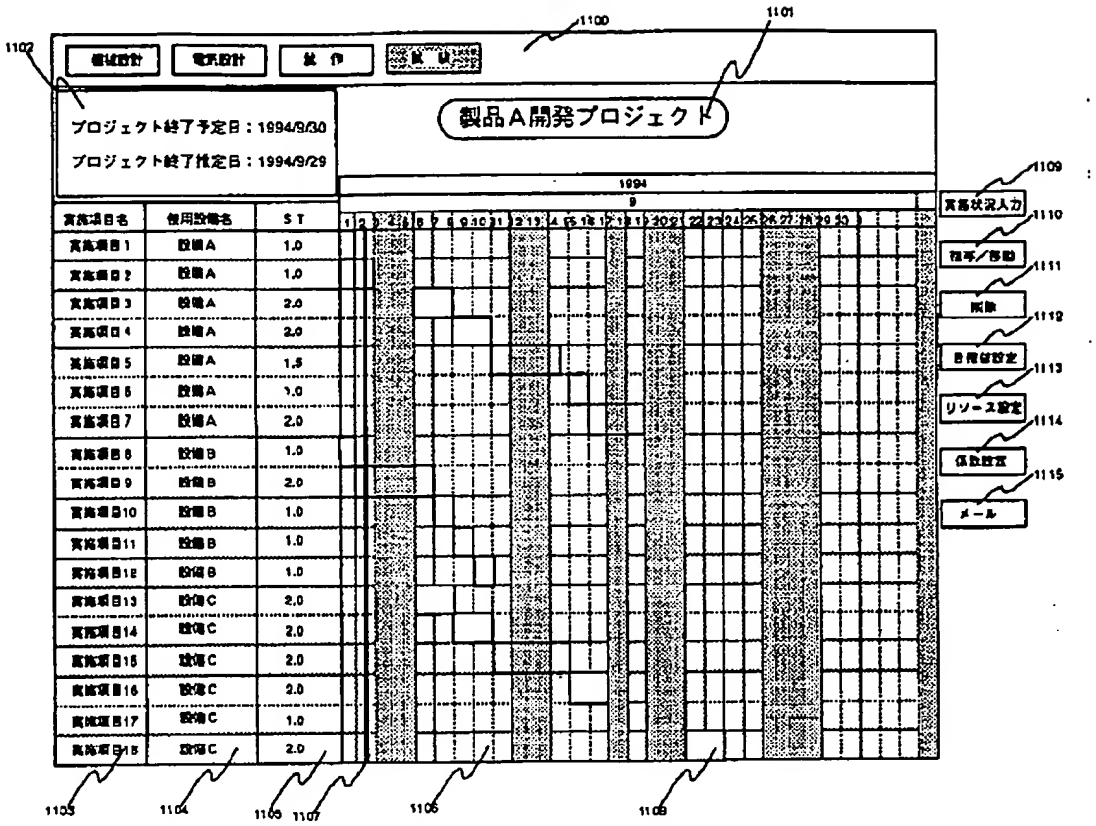
図11.



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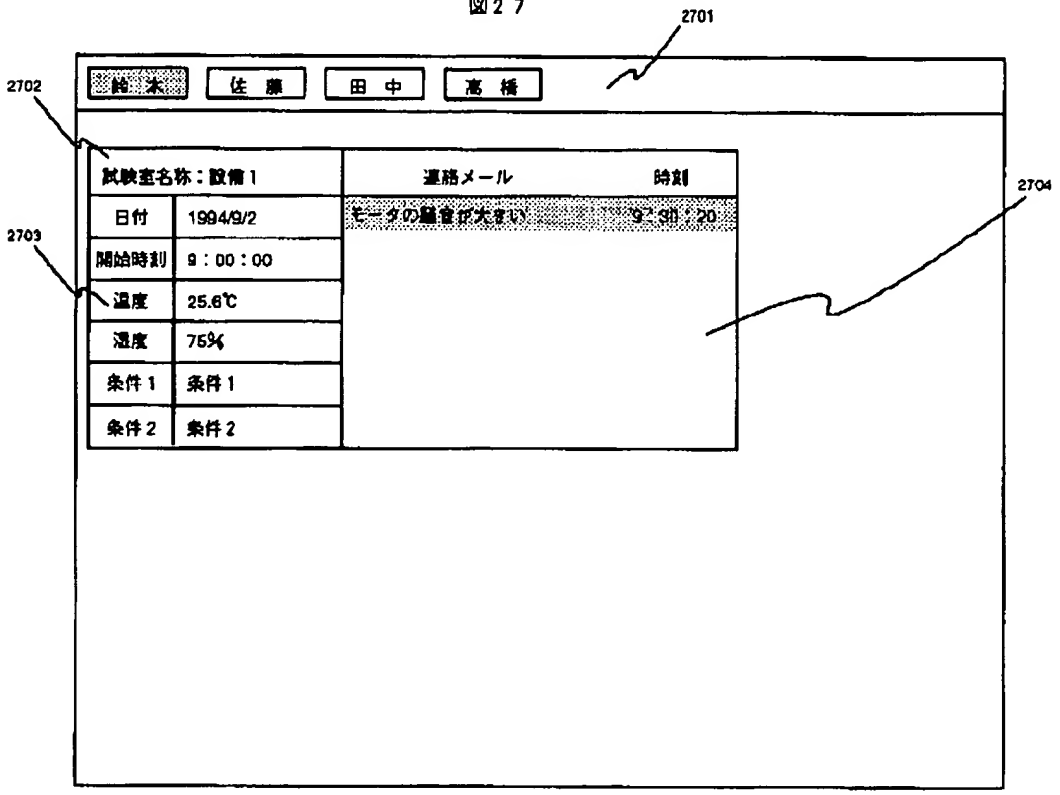

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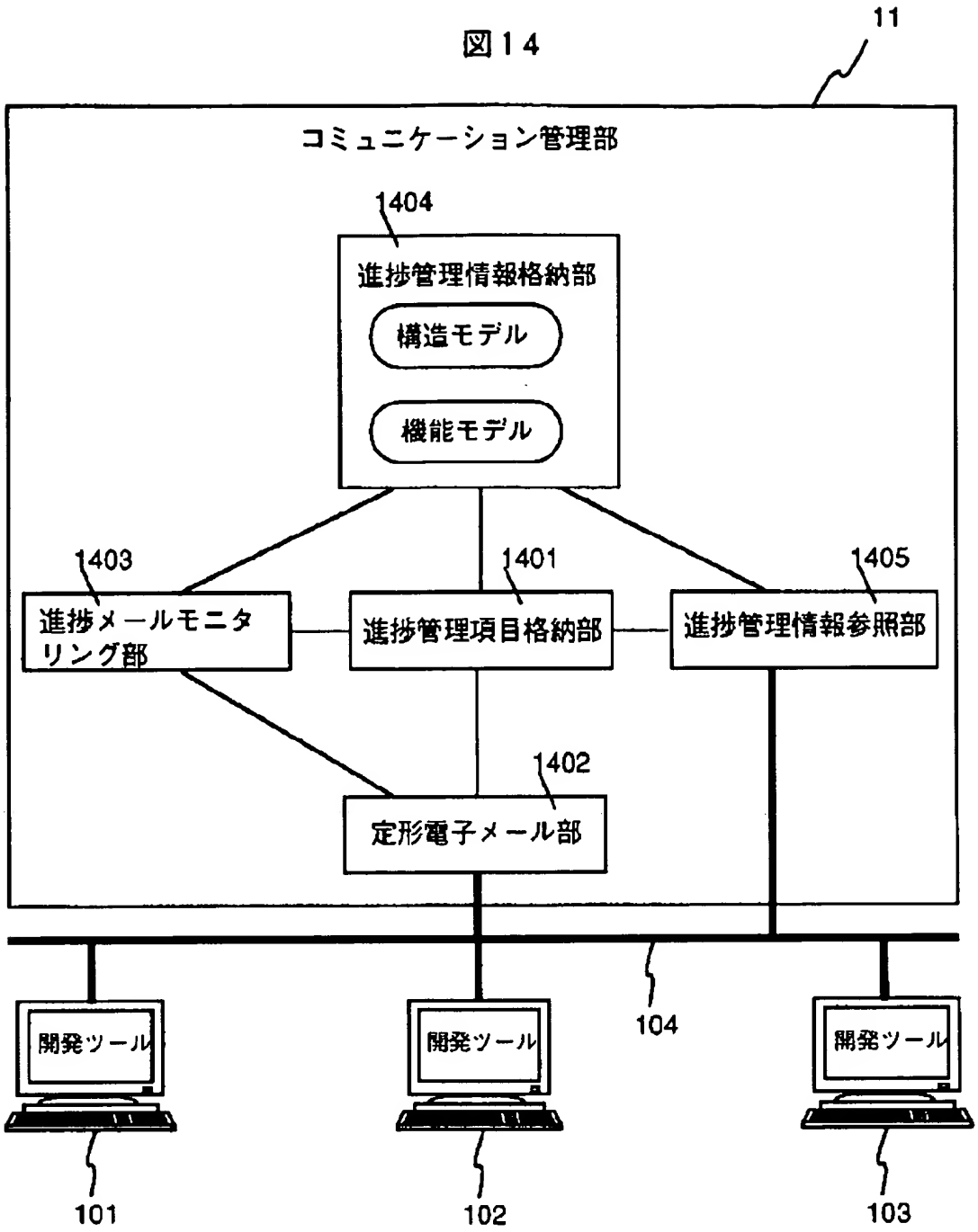

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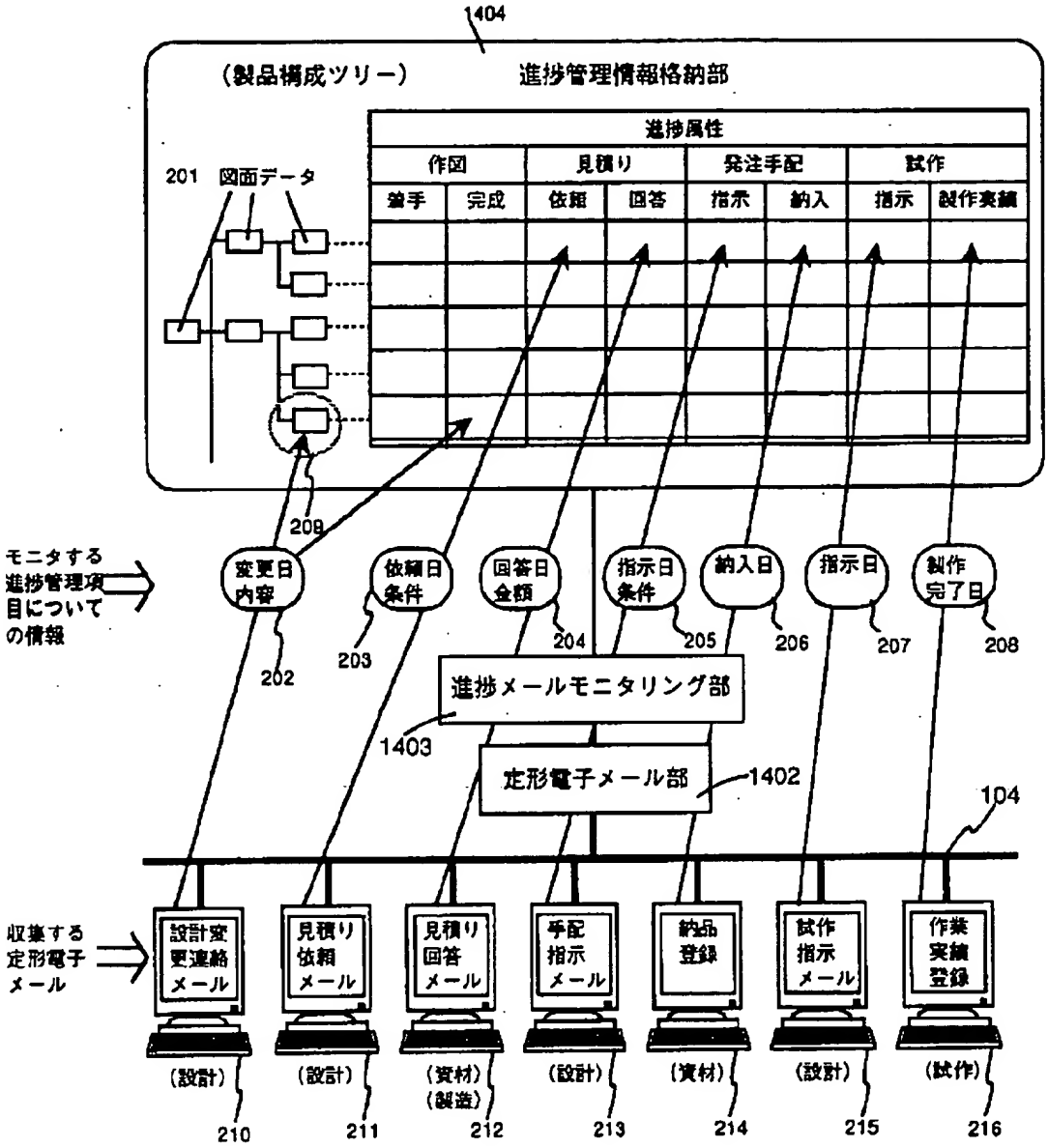

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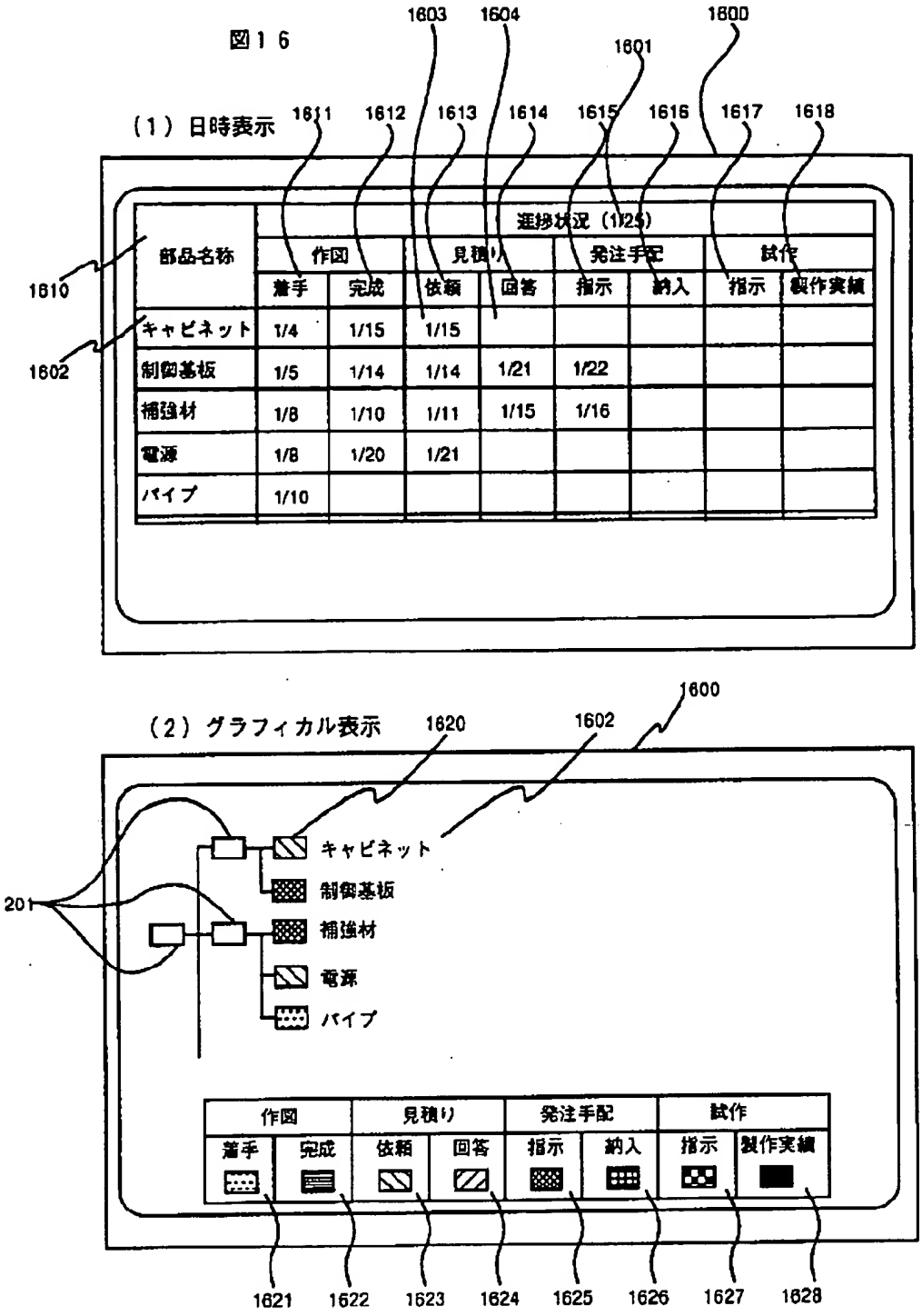

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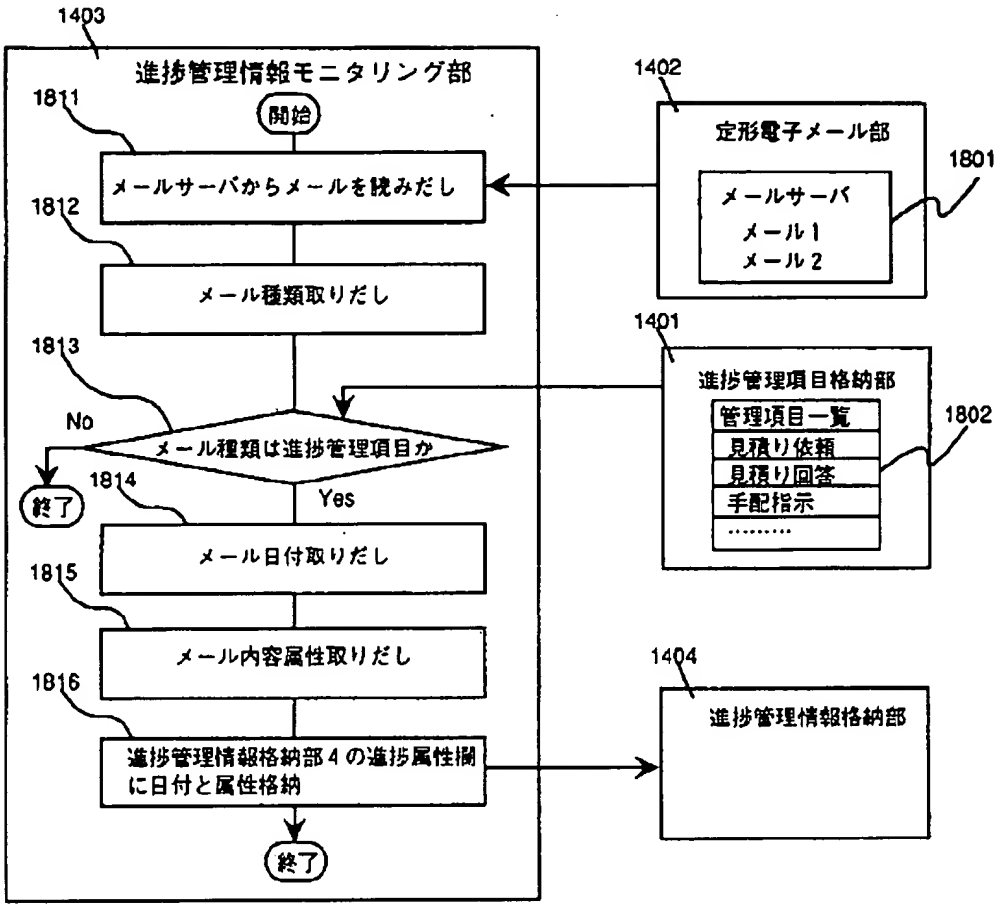

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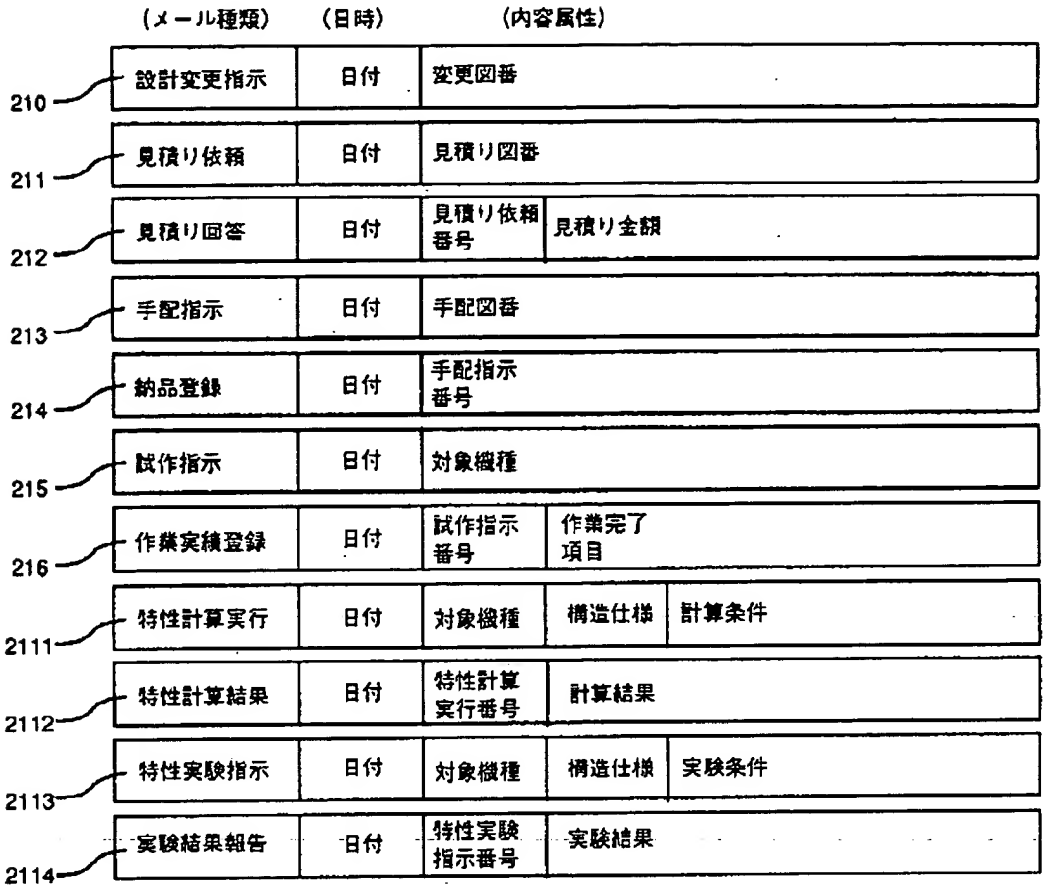

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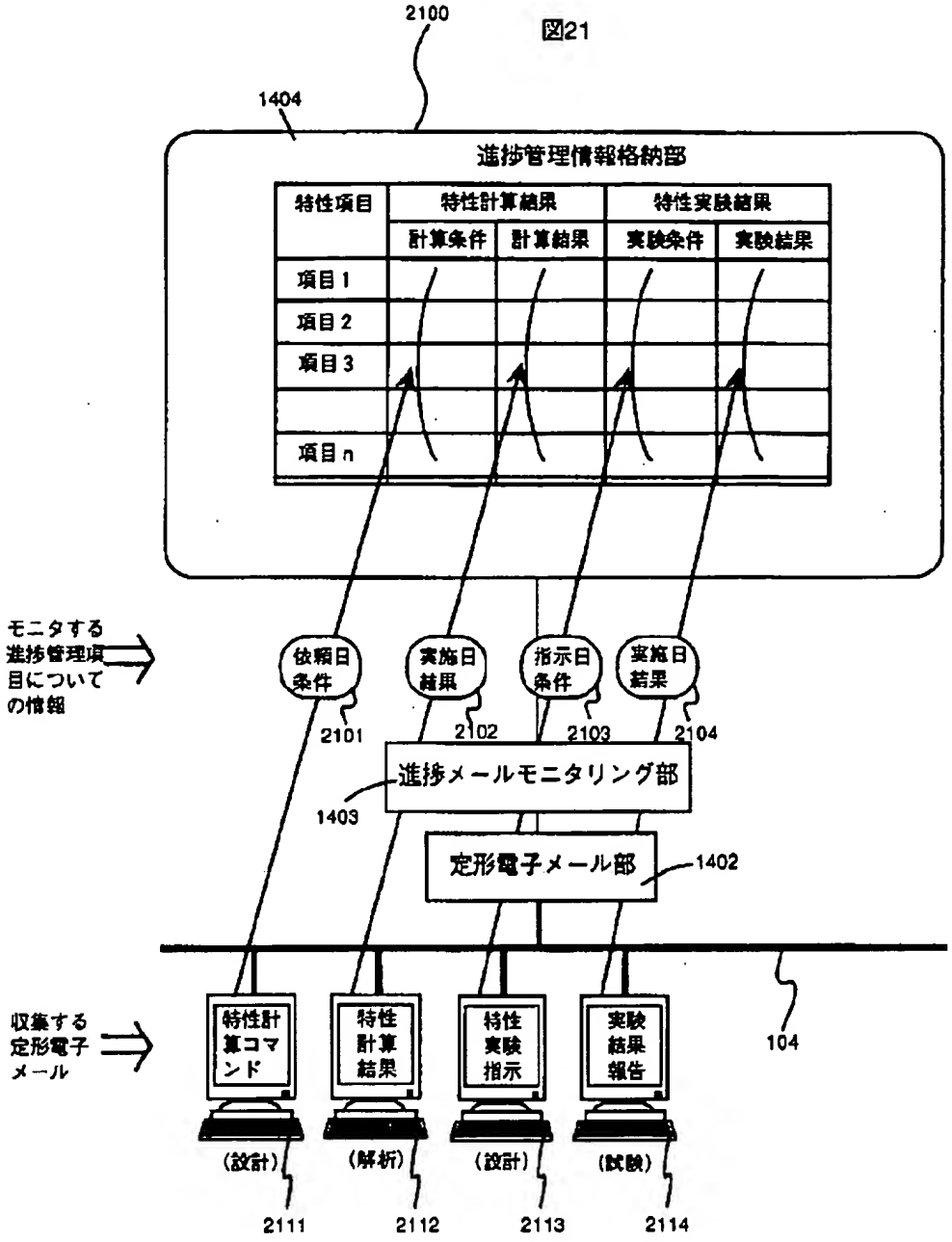
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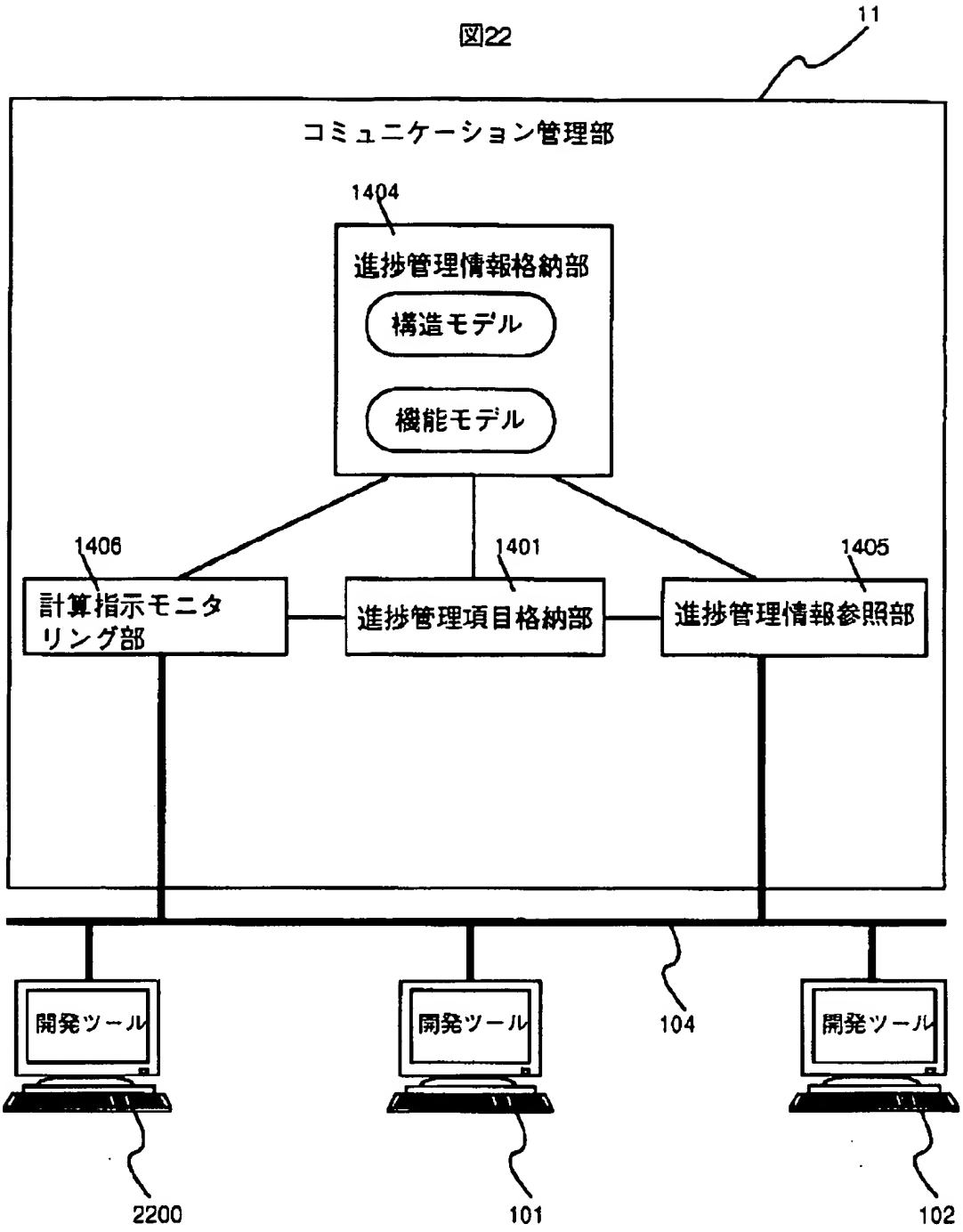
[Drawing 22]

図22



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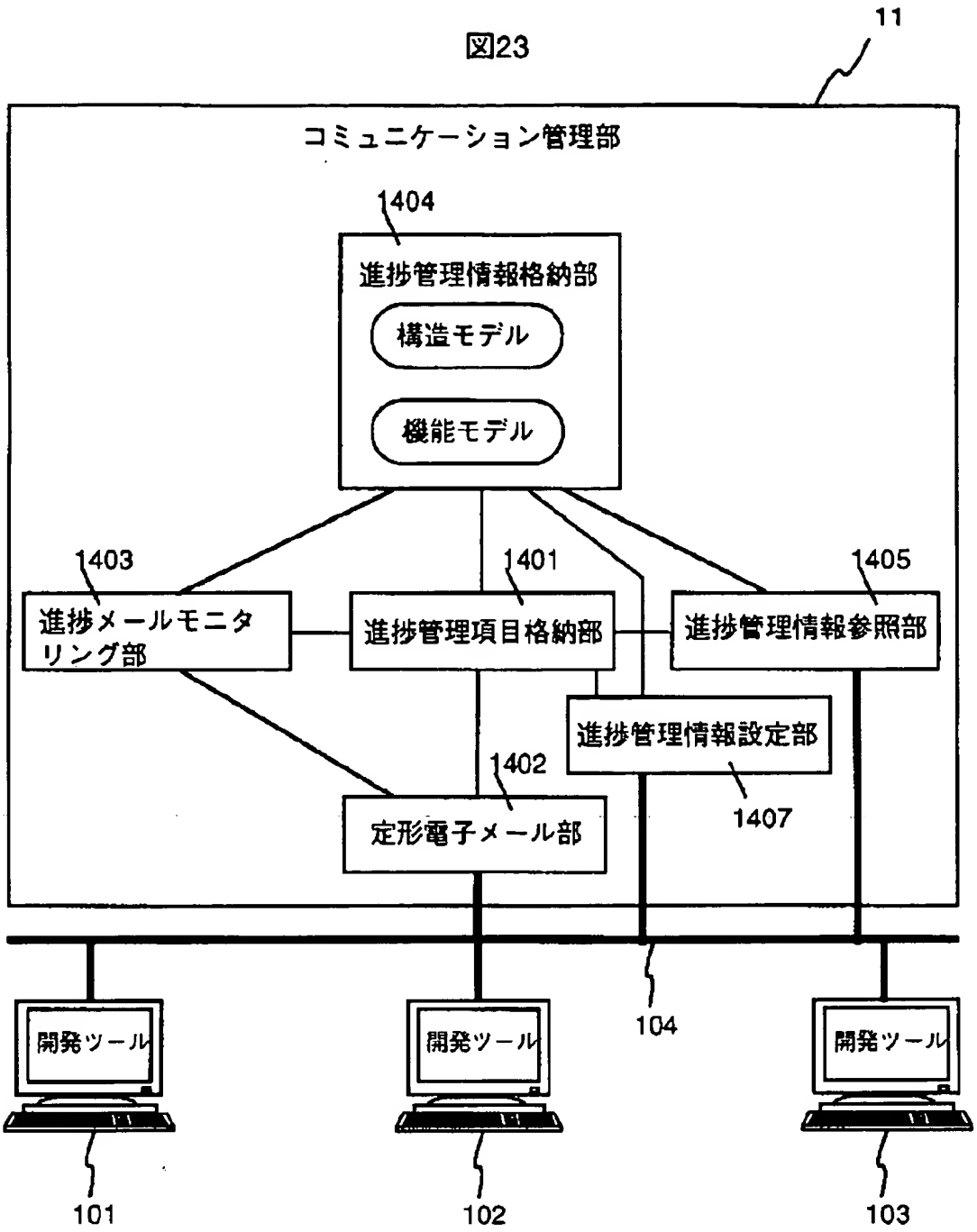

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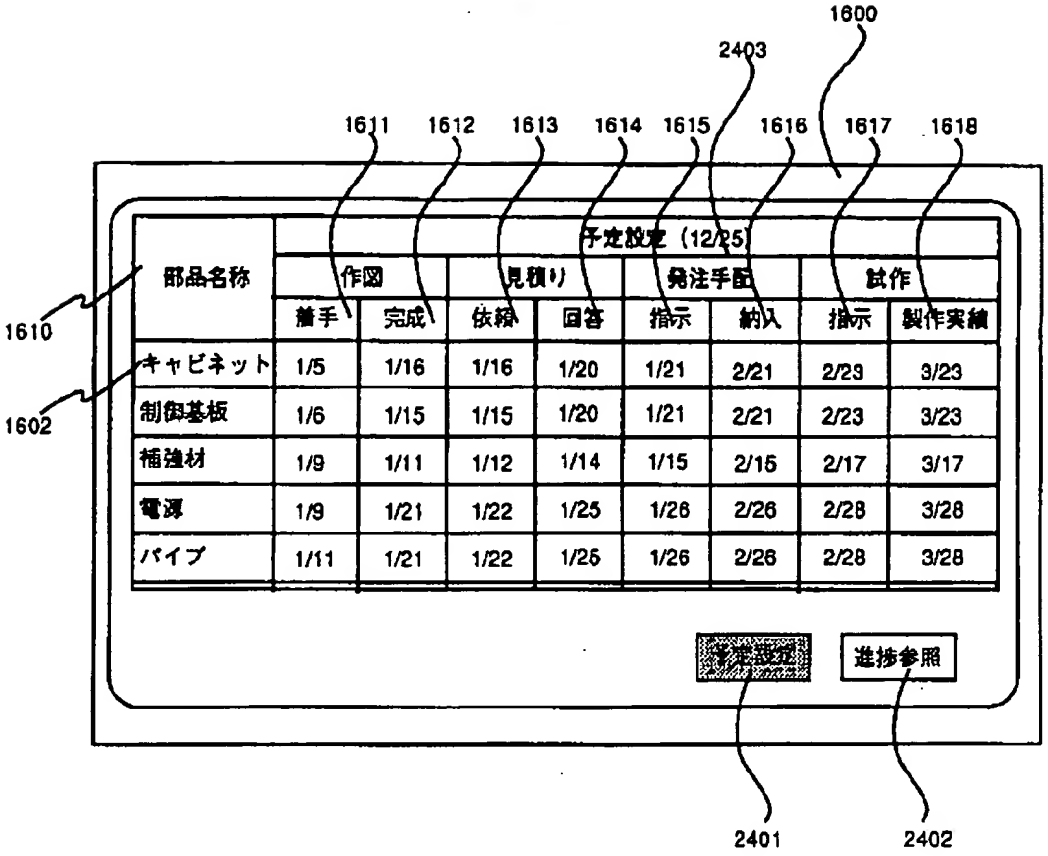

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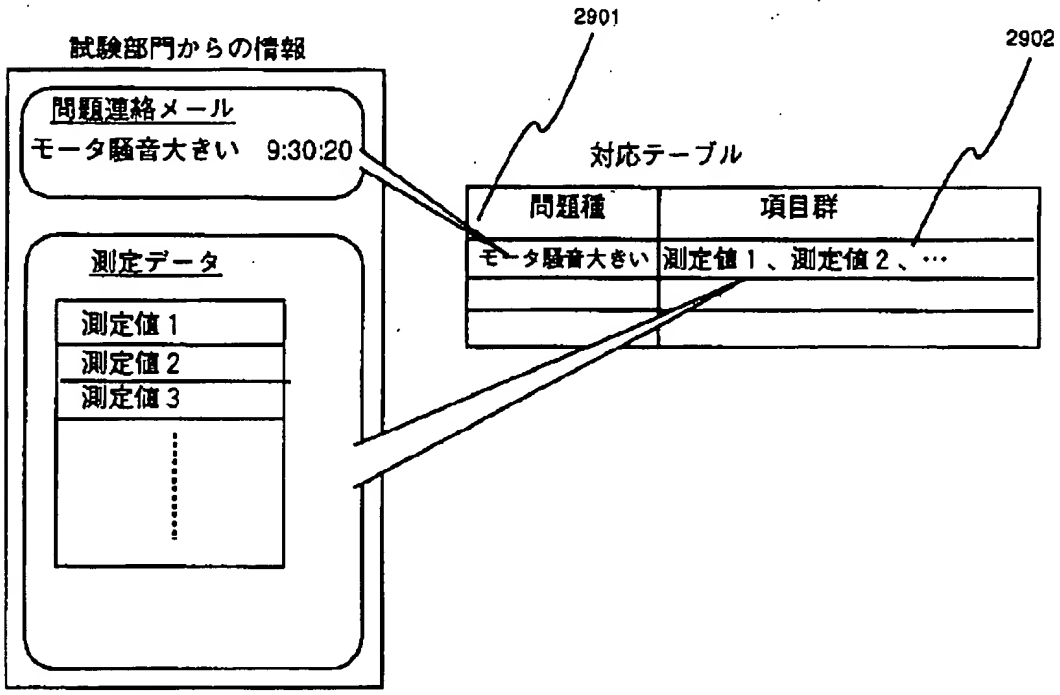

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図25

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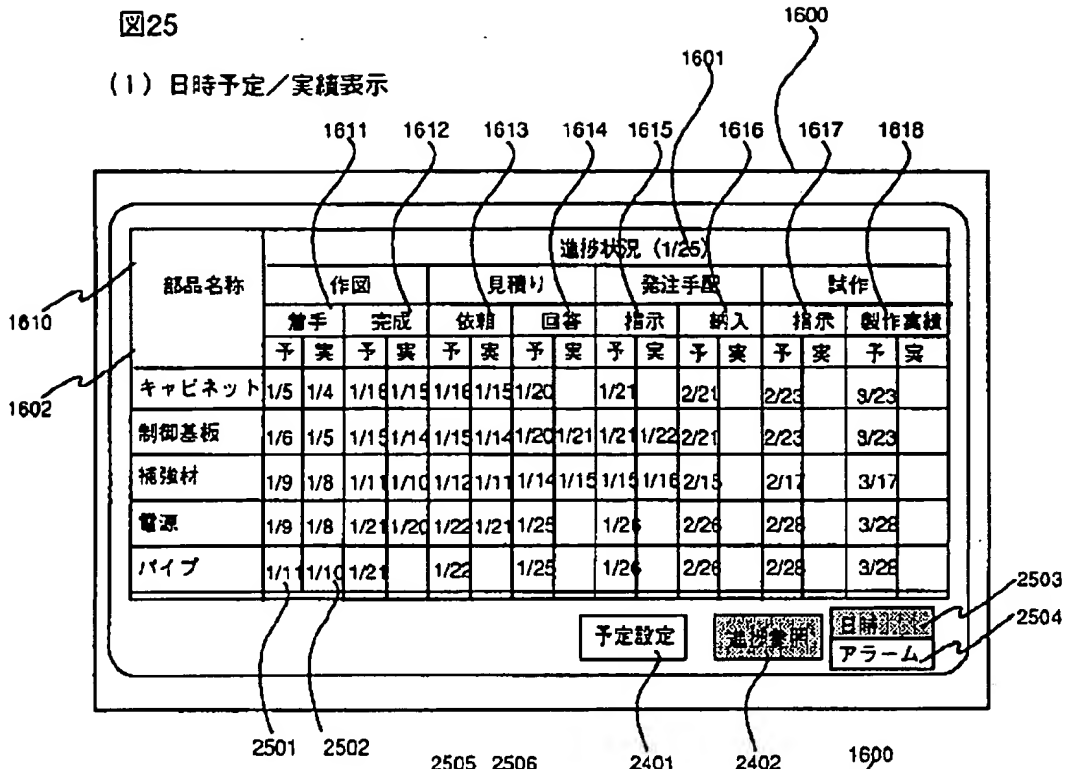

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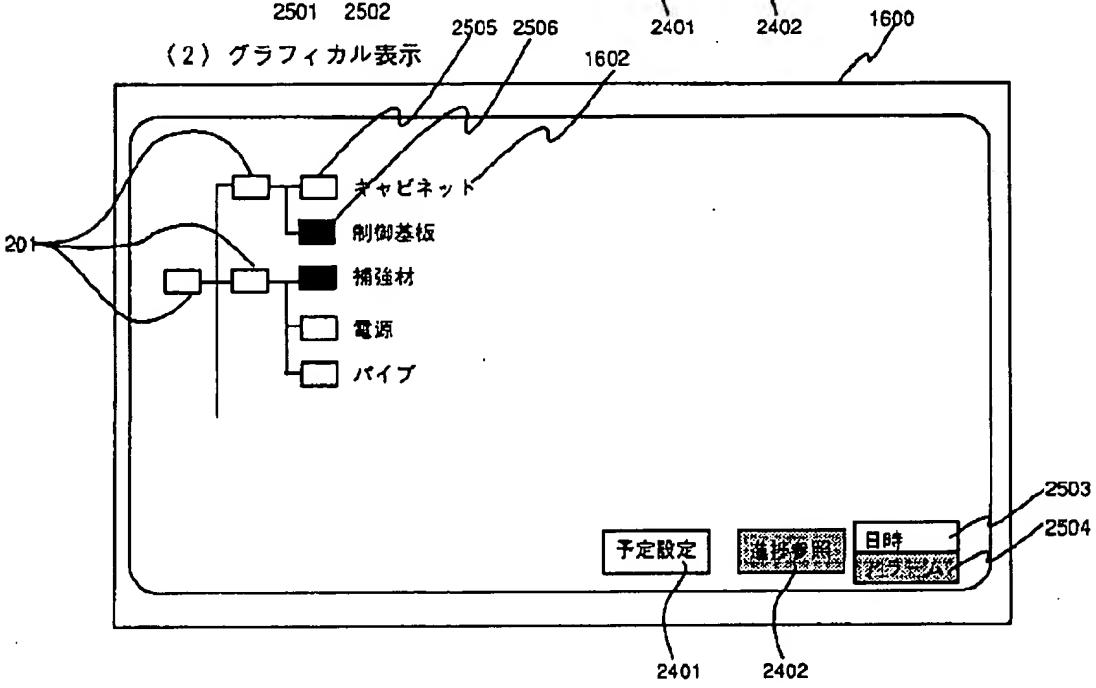

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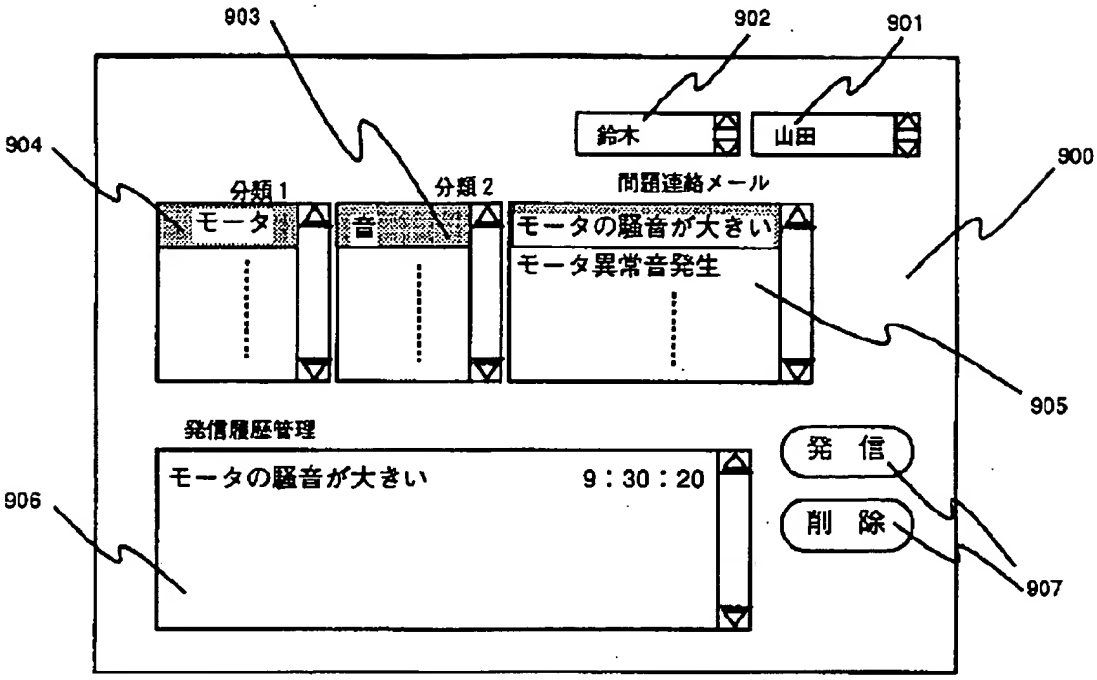

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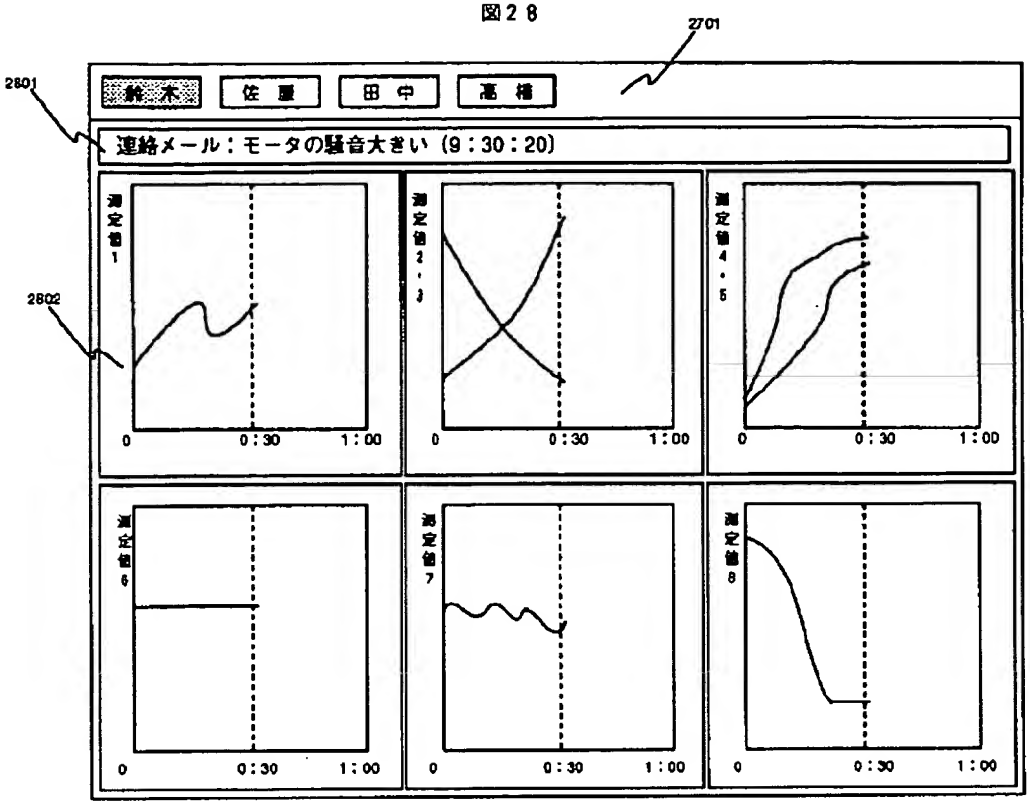

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Integrating the fuzzy front end of new product development

Khurana, Anil; Rosenthal, Stephen R

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ABSTRACT: When asked where the greatest weakness in product innovation is, managers often indicate the fuzzy front end. They recite some familiar symptoms of front-end failure: 1. New products are abruptly canceled in midstream because they do not match the company strategy. 2. Top priority new product projects suffer because key people are too busy to spend the required time on them. 3. New products are frequently introduced later than announced because the product concept has become a moving target. The failure to integrate a product strategy, a well-planned portfolio, and a facilitating organization structure with clearly identified customer needs, a well-defined product concept, and a project plan can severely hamper new product development. An examination of 11 companies aims at improving the effectiveness of the front-end process.

TEXT: Headnote:

The failure to integrate a product strategy, a well planned portfolio, and a facilitating organization structure with clearly identified customer needs, a well-defined product concept and a project plan can severely hamper new product development. An examination of eleven companies aims at improving the effectiveness of the front-end process.

Many companies formulate product strategies, routinely choose among new product concepts, and plan new product development projects. Yet, when asked where the greatest weakness in product innovation is, the managers at these companies indicate the fuzzy front end.1 They recite some familiar symptoms of front-end failure: New products are abruptly canceled in midstream because they don't "match the company strategy. "Top priority" new product projects suffer because key people are "too busy" to spend the required time on them.

New products are frequently introduced later than announced because the product concept has become a moving target.

Times have changed since 1983 when Donald Schon described product development as a "game" in which "general managers distance themselves from the uncertainties inherent in product development and . . . technical personnel protect themselves against the loss of corporate commitment."2 Since then, new product development has become a core business activity that needs to be closely tied to the business strategy and a process that

must be managed through analysis and decision making.3 Now, general managers cannot distance themselves from the uncertainties of product development, nor can technical personnel protect themselves against corporate commitment.

As enhanced capabilities for concurrent engineering, rapid prototyping, and smoothly functioning supplier partnerships have helped reduce product design and development times, management attention has begun to shift to the cross-functional front-end strategic, conceptual, and planning activities that typically precede the detailed design and development of a new product.4 Here, new product ideas gain the shape, justification, plans, and support leading to their approval and subsequent execution. Yet, despite widespread recognition of the front ends importance, there has been limited systematic examination directed at improving its effectiveness.

Our exploratory study of front-end activity in eleven companies highlights best practice based on our assessment of seven critical activities. We begin by taking a systems view of the front-end process based on existing academic and practitioner literature. After discussing how companies should manage the front end as part of a normative model of the process, we use data from case studies to identify challenges and solutions.5 Next, we describe an approach for creating a successful process and present a checklist and diagnostic for front-end practice.

What Is the "Front End"?

Prior research has focused on the success factors for new product development (NPD). While many of these factors relate to design execution and project management issues, some pertain to the front end.6 Consistent with Roberts's model, we classified the front-end-related success factors identified in prior research into foundation and project-specific elements. The distinction is important because the two require different skills and levels of effort. Also, without adequate foundation elements, product and project success becomes a matter of luck. Project-specific activities focus on the individual project and require the project team's effort to ensure a useful product definition and project plan. These include a product concept statement and evaluation, product definition, and project planning. Foundation elements, on the other hand, cut across projects and form the basis for project-specific activities. Thus they typically require enterprisewide support, senior management participation, and a cross-functional effort.

Foundation Elements

Without a clear product strategy, a well-planned portfolio of new products, and an organization structure that facilitates product development via ongoing communications and cross-functional sharing of responsibilities, front-end decisions become ineffective.8 Achieving these preconditions provides a foundation for streams of successful new products.

Key product strategy elements include the formulation and communication of a strategic vision, a product-platform strategy, and a product-line strategy to support the go/no-go decision for a new product.9 Previous research suggests that familiarity with the product strategy enables appropriate decisions on NPD timing and target markets and also an assessment of the fit between the product and the core competence of the business unit.10

In addition to a product vision, business units need to plan their portfolio of new product development activities, which goes beyond the

traditional marketing view of having a product for every segment, market, and price point. Portfolio planning should map all new product initiatives across the business to balance risk and potential return, short and long time horizons, or mature and emerging markets. At the same time, the portfolio plan should ensure consistency with the product and business strategy." If well done, it facilitates the allocation of scarce resources to new product development projects.

An essential precondition is establishing the organization structure for new product development. Decisions on structure, communication networks, and roles are made at a business-unit level. Research has highlighted several requirements for the product development organization and its functioning,lz such as using a matrix or project form, organizing NPD around core business/product teams rather than traditional functions, using design and communication tools including information systems, and establishing controls and incentives as rewards.13

Project-Specific Elements

Product-specific front-end activities help clarify the product concept, define product and market requirements, and develop plans, schedules, and estimates of the project's resource requirements. However, they stop far short of creating detailed designs and specifications for the product and its components.

The product concept is a preliminary identification of customer needs, market segments, competitive situations, business prospects, and alignment with existing business and technology plans. Research suggests that the product concept should be clear so that managers can sense whether the newly defined opportunity seems worth exploring.14 Managers need to understand customer needs and identify the potential technologies and applications to satisfy them.15 For tangible products, the product concept is usually illustrated with a sketch or three-dimensional model. Because such concepts are relatively inexpensive to produce, managers often create several before selecting one to fully design and develop. Early targets measured in product cost, product performance, project cost, and time to market - set the stage for generating various product concepts.

The product definition, an elaboration of the product concept,16 incorporates judgments about the target market, competitive offerings, and the time and resources for bringing the new product to market. The definition activity includes identification of customer and user needs, technologies, and regulatory requirements. These lead to a choice of product features and functions, target market segments, and design priorities. Research on the implementation of the front end indicates that an explicit, stable product definition and an understanding of the trade-offs among customer requirements, technology, and resource/cost constraints are important factors for success.17

Project planning includes project priorities and tasks, a master schedule, projected resource requirements, and other supporting information. Here, it is critical to communicate the project priorities, provide adequate resources, and anticipate contingencies. And, despite progress in new product development practices, typical systems do not adequately address these critical issues.18

The Front-End Process

We take a process view of the front end because earlier studies and our preliminary research suggested that the individual activities, while logically interrelated, often are treated independently.'9 Accordingly, we

present a systems view of the front end (see Figure 1). This process description is consistent with growing empirical evidence of the need to simultaneously consider overall product strategy (foundation elements) with project-relevant input such as product ideas, market analysis, and technology options.2 Thus understanding the interrelationships between the activities is as important as the activities themselves.

Product strategy and portfolio plans should drive the complete new product development effort, in conjunction with the capabilities and competencies of the product development organization, with its inherent assumptions about roles, communications, and culture. These elements are thus preconditions or foundations for the explicit activities in new product development. Many companies implement a formal phase-review management system to define and guide the explicit project-specific activities; this review process involves the process itself, roles that make it work, and primary deliverables.2

Phases of the Front-End Process. Companies generally begin work on new product opportunities (often called "pre-phase zero") when they first recognize, in a semiformal way, an opportunity.22 If the newly defined opportunity is worth exploring, the company assigns a small group, sometimes including suppliers, to work together on the product concept and definition (phase zero).

(Chart Omitted)

Captioned as: Figure 1

In phase one, the company assesses the business and technical feasibility of the new product, confirms the product definition, and plans the NPD project. Thus the development team identifies the new product, its development, and the business rationale for proceeding. The front end is complete at the end of this phase when the team presents the business case and the business unit either commits to funding, staffing, and launch of the project or kills the project.

Front-End Roles. A core team (including the project leader) and an executive review committee of senior functional managers responsible for making the go/no-go decision typically conducts the process we've described. During phase one, if not sooner, companies assign individuals from all functional areas as members of the core team for the product development project. Normally, if a company approves the project at the end of phase one, a full complement of people to design, develop, test, manufacture, and launch the new product supplements the core team. Previous studies have indicated that team structure varies in composition, size, and leadership. Often, the core team includes selected suppliers as partners; their knowledge of technology, costs, and design and manufacturing lead times can contribute to product definition and project planning.

Primary Front-End Deliverables. The front-end activities result in the product concept (clear and aligned with customer needs), the product definition (explicit and stable), and the project plan (priorities, resource plans, and project schedules).24

Front-End Challenges and Solutions

To understand the front-end processes and practices at fifteen business units in eleven U.S., Japanese, and European companies, we interviewed more than seventyfive managers (for our research approach, see the Appendix). Our study focused on incremental innovations - the majority of NPD efforts.

Accordingly, our findings deal with improving the performance of existing products or extending them to new applications, rather than with developing radically new products.

(Table Omitted)
Captioned as: Table 1

We have grouped the typical practices that characterize the foundation elements and project-specific activities into three implementation clusters -high, medium, and low (see Table 1). This analysis of our data also supports our earlier literature-based classification of the three foundation elements and the three project-specific activities. Our analysis does recognize an additional activity: adding value-chain considerations to the front-end process.

We found significant gaps in how the case study companies implemented the seven front-end elements, even for those companies that claimed to have the front-end product generation processes we described earlier (see Table 1). Even the companies that prepared their own detailed process descriptions generally didn't avoid problems that they could have resolved at the front end. In fact, only companies F and, possibly, G and J could claim to have most of the capabilities for an effective front end.

Foundation Elements at the Case Study Companies Next we discuss in detail how the case study sites managed the foundation elements in order to provide insights for companies trying to improve their NPD efforts. Product Strategy. Our research suggests that despite their intentions, very few companies have clear product strategies to guide their decisions on new product opportunities. In our sample of eleven companies, we rated only two as outstanding (F and G) and two as satisfactory (D and J), while the remaining seven were seriously lacking. We identified several deficiencies in formulating and articulating a product strategy and the connections between product strategy and the core NPD activities (see Figure 1):

There were product development teams and product managers, but no one was in charge of formulating a product strategy, even at the senior management level.

Several of the companies made new product development decisions based on project-specific criteria rather than considerations of strategic fit. Business strategy was not specific to markets and products.

(Table Omitted)

Captioned as: Table 1

R&D, largely insulated from the product development group, funded projects based on superior technology rather than on their potential to satisfy particular product requirements.
The outstanding companies in our sample had countered these deficiencies. The power of a clear product strategy was evident at company F, where we studied the fourth in a series of eight planned sequential product launches based on a common platform.25 The company had designed this platform to meet explicit customer, market, and technology guidelines, with which each successive release was consistent. The vision of the business, product, project, and technology enabled successive product development teams for this platform to consistendy deliver a product that met every target.

Product Portfolio Planning. More than a third of the companies studied did not plan a product development portfolio. Even when they did, planning at

all but two of the research sites, F and J, was sporadic and incomplete. This neglect can be traced to a combination of vague product strategy, measurement difficulties in establishing risk/return profiles, and ambiguous overall responsibility.

While company H traditionally lacked a clear product strategy, senior managers had begun to realize that they were in a mature, threatened business. In response, they made their functional managers aware of basic portfolio planning, with encouraging results. Their portfolio now includes a combination of different products with both established and new technologies, instead of traditional projects with incremental improvements to the familiar product line. The company also enhanced the role of the executive review committee, known as the product approval committee, to include assessment of the match between a new product concept and the existing product portfolio in risk, time horizons, and markets.

In contrast, company F - which is very successful in its business --constantly monitored the parameters of its product development portfolio, such as time horizon, risk, expected returns, required investments, and needed capabilities. Senior managers and project and product managers continually discussed the nature of the development portfolio and additions to make.

Regardless of the methods a company uses for new product portfolio planning, it needs to be part of an integrated front-end process. Our research suggests that there is often a discontinuity between portfolio planning and the front end of the traditional process. For example, if a project is killed at the front end because of technological infeasibility, the resulting gap in the developmenT portfolio will become apparent only if front-end activities and portfolio planning are linked.

Product Development Organization Structure. We focus here on three roles at the front end- the project leader, the core team, and the executive review group - and on related communication structures.26 At the companies that measured best along this dimension (F, G, and J), the project leader was responsible for promoting the interests of the project and the core team right from the start. This role included lobbying for support and resources (being an "ambassador") and coordinating technical or design issues.27 These project leaders initiated such communication early during the product/project definition and planning stages. At company F, project managers established communication channels, role definitions, and cross-functional mechanisms for the development team, as part of the product and project definition.

All the companies in our sample, except for companies B and E, had a cross-functional core team do the analytic work of product definition and project planning. However, the role of the team varied among the companies and development projects. Company As first autonomous product development team was successful because four ambitious, creative team members communicated well. However, subsequent teams were not as successful because the core team members were unclear about their responsibility in creating the product concept and definition. In contrast, teams at company F operated more systematically and successfully. A small core team including the idea champion, a senior manager, and a potential project leader met early on and negotiated key roles and responsibilities. This nucleus group then recruited the fill team and ensured that all members agreed on the definition of roles and responsibilities. This structure of team roles and responsibilities was part of the product concept statement and was formally acknowledged in the product definition and project planning documents. Establishing the core team early, clearly defining roles and

responsibilities for the team, and facilitating supporting communications played a major role in company F's success both in new product development process and the market itself

Product success appears to be strongly associated with establishment of a cross-functional executive review committee. Only companies F and J had such a review. Company As review coni'committee focused on technical issues, with the result that executives failed to have a holistic perspective. In contrast, the committee at company F used each phase review to develop strategic and operational skills and establish norms for communication and consensus building. It also guided the core team while making critical choices and trade-offs or making decisions that might have an impact on the business unit's strategy beyond that particular product. At both companies F and J, th executive group worked like a business team rathe than functional representatives, consistently develoPe(product strategy and engaged in new product portfolio planning, and formulated explicit project priorities (time, cost, and quality).
For an effective front-end process, the roles of the project leader, the core team, and the executive review committee must complement each other. Explicitly defining these roles by answering the following questions will make the front end less "fuzzy": Should the core team resolve product definition and project planning issues or refer them to an executive committee?

Who is responsible for ensuring that product definition and concept testing are balanced between thoroughness and speed?

Who should ensure that resources are allocated to a project, as specified in the project plan?

Who should identify emerging technologies for inclusion in future product platforms? Who has the authority to ensure that products developed by several business units or a unit and one or more "partners" are aligned along product/component interfaces, development schedules, market focus, and technology commitments?

Project-Specific Activities at Case St Companies

Now we concentrate on project-specific activities at the front end: clarifying the product concept, stabilizing the product definition, considering the value chain in the product definition, and defining and planning the front-end project.

Product Concept. Our research revealed that clarifying the product concept at the front end was surprisingly difficult. Only four companies (C, D, F, and G) had succeeded in consistently developing clear, explicit, and precise descriptions of the product concept. At several companies, the concept was unclear because senior managers did not communicate their expectation of the product's core benefits, choice of market segments, and pricing to the development team.

One company resolved this gap between management's vision of the product concept and the team's understanding of it by setting specific criteria for the features appropriate to the product. It created a database for new product features -- based on various inputs from field service, special customers, R&D, marketing, and customer feedback. It then assessed these inputs in phases zero and one, based on senior management's vision of the product, engineering feasibility, market needs, resource requirements, price targets, and schedule - and classified them into "red," "green," and "yellow" items. The company would never pursue red items in the current

program (but could consider them for the next-generation product). Green items were necessary for the current product; the company chose them based on need, feasibility, and other constraints. Yellow items needed more evaluation, so the company postponed them for subsequent release.

At several case study sites, the product concept was unclear because the companies did not clearly understand customer needs. When such problems recur, as we found at companies H and K, products lack what Clark and Fujimoto call "external integrity "Zs To make customer expectations and product features more consistent, sophisticated companies (such as companies C and F) try to look beyond the customer's "voice" to "action," by using techniques such as videotapes of customers' use of existing products.

Product Definition. All the companies in our study realized the pivotal importance of the early product definition. Yet most had failed to generate clear, stable definitions. While rapid shifts in technology and markets make it impossible for some companies to freeze the product definition, most of the companies studied acknowledged the difficulties this caused in the execution stages of product development projects and the high associated costs. In fact, only managers at companies C and F felt that they had developed approaches for dealing with instability and change. For technology-driven companies (especially company H), delays in product definition entailed the risk of an unstable, expanding definition in which design engineers continued to add unneeded complexity. Managers at companies C and F made a concerted effort to freeze the product definition early on. For them, the challenge was to balance the requisite flexibility with the avoidable uncertainty.

Company F discovered a creative solution for keeping up with and capturing market information while minimizing changes in the product definition what we call the "missed elevator" approach. The program manager realized that technological or feature enhancements for any product would never end. He required the product definition to include new features and feasible solutions to customer needs, as long as they could definitely be achieved by the planned milestone for that product release. If a customer need or technology-driven feature "missed the elevator," it would go into the next product release or "elevator." This approach to managing product development by having multirelease platform planning may become the next form of product development and management. Not only does it help achieve a balance between stability and flexibility, but it also leverages technological strengths and organizational resources.29 Thus more companies now include, in their frontend deliberations, the definition of multiple-release products, in which each release intentionally involves only a moderate level of new technology development.

Value Chain Considerations. While NPD research has highlighted the suppliers' role in new product development, we found that some companies have a broader value chain perspective at the product concept and definition stages.30 This becomes necessary as product designs and market delivery systems are more competitive and complex. And customers do not buy only the tangible product but a package that includes the product itself, the company, the brand image, the sales interaction, the delivery process, the after-sales service, and the follow-up relationship. The development team should envision and plan for this package at the front end; otherwise it may ignore downstream requirements and not design products for ease of distribution, installation, or repairs.

We found that these practices, while familiar at the execution stage, are less aggressively and creatively pursued at the front end. Of the eleven

companies in the study, only four (A, D, F, and J) were adequate along this dimension. We observed several failures and some creative solutions. Company A, a special industrial products manufacturer, faced new maintenance problems and poor telecommunications support in providing field service. As a result, field service engineers became regular members of the core development team at the front end. At company D, the new product development team consulted with so-called "customer supply specialists."

As another example, Hewlett-Packard's printer division had thousands of stock-keeping units (SKUs) for its products being shipped to different parts of the world. HP resolved this problem of excess variety with "design for postponement"; it redesigned the product so that only the core printer SKU was stocked in regional distribution warehouses. It stocked attachments such as power packs, power cables, connectors, and even instruction manuals in different languages at the distribution points and assembled the final package for shipment only after it received a firm shipment order. In fact, it designed the packaging itself so that it could easily insert and assemble all the attachments. The result was enhanced flexibility and reduced inventory costs, along with the needed product variety." For all subsequent product development efforts, HP has routinely included downstream considerations at the front end.

Front-End Project Definition and Planning. At this part of the front end, we observed confusion about project priorities, incomplete resource planning, and inadequate contingency planning. Our discussions with core team members and project leaders led us to believe that fuzzy project priorities were the single most important reason for NPD delays, product overengineering, and product-strategy mismatches.
For example, company A initiated its mid-range product as a cheap-technology, low-performance version of its high-end product. Yet management had always visualized a cheap-technology, high-performance product. Finally, when the product came on the market several months behind schedule, it exceeded its performance targets but no longer met its unit-cost goals. At another company, managers solved this common problem by comparing - at the front end three kinds of project priorities for any new product development project: scope (product functionality), schedule (timing), and resources (cost). Senior management, the core team, and the (as yet unappointed) project leader at the pre-phase zero stage decided the relative ranking of the three priorities for the project's duration and communicated it to all project participants.

Companies must anticipate resource requirements, train people to acquire the necessary capabilities, and then ensure needs-availability matching based on project priorities. Executives repeatedly told us that they had too few people to staff their many NPD projects. At company J, managers used a capacity matrix to assess and assign staff. Senior managers selected the best projects, set goals, and reserved resources. Company F, which also used a form of capacity matrix, faced a complicated challenge of resource planning. Like every organization, it had a core group of irreplaceable people who were in great demand for every project. When planning a next-generation product, the managers realized that the team member they wanted was heading a current project. To avoid such problems in the future, management resolved to both train more people for such assignments and also plan early for staffing and skills requirements.

Companies can manage the risks of new product development with thorough contingency planning - generating multiple product concepts, developing alternative technologies in parallel and, in some instances, even creating competing designs for products or subsystems.32 Yet, surprisingly, we found that most companies (including company F) focused contingency plans mostly

on regulatory issues such as safety or environmental requirements. Apparently, project planners assumed that they would find technology solutions without considering cost and quality. When the timing of a new product introduction is important, reasonable back-up plans are needed to avoid delayed market launch. One approach is to build in contingent product features in case the planned ones do not work. Taking risk management seriously and linking product definition activities with project planning can lead to appropriate contingency plans.

Recognizing Interrelationships

Next we discuss several critical interrelationships among individual success factors and approaches for managing them.33 Our examples are from company F, which had the most effective front end of the cases studied. Companies should consider product strategy and the product development portfolio at the start of the project-specific front end. Company F held a kickoff meeting even before it had refined the concept and assembled the full core team. Attendees included senior managers, the idea champion, and some core team members. While much discussion focused on the basic product concept, it also included how the concept filled a gap in the business strategy and how it related to and compared with other products and ongoing projects. As a result, subsequent problems of mismatches between the product and the product strategy or shortage of project staffing were rare. Companies should have a clear product strategy to enable a stable product definition. Everyone at company F accepted the notion that product strategy should guide technology choices and selected product features. Thus the company used its multirelease product strategy to simplify the definition: its adoption of the "missed elevator" approach simultaneously encouraged stable technology and feature choices that were governed by a long-term vision over several product releases, while facilitating new releases on time.

Companies should integrate portfolio planning and NPD project planning. Company F had established two distinct but formally linked planning processes. The strategic planning process involved managers from various functions and considered product strategy, product development portfolios, and overall resources. Thus portfolio planning yielded long-term commitments that the managers could invoke when planning staff requirements and project priorities for a specific new product concept. They implemented two important practices when planning individual projects: establishment of schedules and allocation of staff and budgets, and specification of inputs such as technology from other business groups. First, they made the strategic business plan available to all core team members and considered the product definition in the context of the strategic business plan. Second, senior managers oversaw the core team's decisions and actions. For example, the project manager may be a part of the strategic business planning process or may report to someone who is.

A Well-Engineered Front-End Process

How can a company improve its front-end practices to achieve success in new product development? Is it enough to improve the activities we have described? We suggest that best practice in new product development goes beyond simply adopting these activities. Success depends on how companies integrate dimensions and elements of product development."
Our research highlighted certain challenges in integration of the front end beyond the obvious need for cross-functional effort. First, because project-specific activities build on foundation activities, companies should ensure that the foundation elements are aligned with the product development process and projectspecific activities. Second, they should

ensure consistency between strategic and operational activities. The challenge is to make strategy explicit enough to guide day-to-day choices for new product development. We found the integration of these two factors was rare but extremely potent. At the companies studied, we observed several kinds of integration problems:

Senior managers sometimes delegated the formulation of a product strategy to product and R&D managers. The product development staff often made decisions that affected other products and business unit strategy. (While the core team faces technical uncertainty about the product and manufacturing and distribution processes, resolving cross-project issues or providing guidelines should be senior management responsibilities.)

Managers in various functions and organizational levels rarely ensured consistency and links among R&D activities, product strategy, and current product development. (Huge R&D investments can be wasted by pursuing superior technology capability unnecessary to the organization's espoused business strategy.) Managers frequently took on product development projects without committing adequate resources. (Often there is a misconception that product development staff working on multiple projects improves efficiency. The result is long delays in product launch and lost revenues. With ongoing downsizing in many companies, this kind of neglect is becoming chronic.35 Senior managers need to help product and R&D managers understand a projects relative importance.) Senior managers did little to measure and reward crossfunctional teamwork. (Front-end participants need to know that management values their contributions.) Balancing Front-End Explicitness and Flexibility Management of the front end also requires a balance between getting things right and being flexible during NPD execution. Other front-end elements and activities should also be balanced. There is a natural tension between planning to reduce risk and responding to inherent uncertainties. For example, we suggest that product strategy and portfolio planning be explicit, yet we recognize that some subsequent shifts in the product definition are inevitable, forcing contingent actions. Furthermore, postponing the final decisions at the front end by continuing the development of parallel concepts or solutions may reduce uncertainty.36 While our research did not focus on this issue, we believe that there must be a balance between front-end planned activities and ongoing iteration during the NPD project, between making "final" decisions early and intentionally keeping open parallel alternatives, and between establishing product development targets through analysis and working by instinct alone.37

Diagnosing Front-End Activities

Based on our study findings, we propose that companies evaluate their front end on degree of formality and the integration of activities. The dimensions formality and process integration - can be measured on a checklist (see Table 2). The items are derived from previous research and our case study findings on the need for formality and integration at the front end. The diagnostic statements evaluate the explicitness and formality of front-end practices. The statements on integration document how well these and other front-end activities are integrated.

A senior business unit manager such as the vice president of R&D, chief technology officer, or director of new product development should assess business practices and then calculate the score of the business unit, counting a check for any item as one point. The sum of the scores on the formality statements gives the formality score; the sum of the integration statements, the integration score. The manager can then map the score on each dimension on the frontend capability map (see Figure 2).

(Table Omitted)

Captioned as: Table

The mapping indicates how well (or poorly) a business unit is doing along the two dimensions of formality and integration. Our research indicates that world-class companies score eight or more on both dimensions. Companies that score three or less on either dimension have a deficient front end and are likely to have major problems with their product development efforts. Senior management needs to find ways to improve these efforts; the checklist is a first step to understanding where and what to improve. What is more difficult is to understand how. In the next section, we discuss how companies and business units can plan a transition to a better-managed front end.

Managing the Transition

All the companies we studied were moving toward a more explicit, integrated front end. They were trying to build complementary capabilities to support the critical go/no-go decisions and development plans for new product concepts. Yet each was taking a different path at a different rate.
Stages of Evolution

We see three stages in the product development front end, not including the stage in which a company has no formal front end - the pre-emergent stage.' The next stages are awareness," "islands of capability;"and "integrated capability" (see Figure 3). The triggers to reach the awareness stage from the pre-emergent stage are typically growth, additional product line complexity, or competitive pressures for either more product innovation or lower product development costs. In any case, at the awareness stage, companies recognize the significance of the front end but have little capability associated with it. They score poorly on both the formality and integration dimensions, as did companies B, E, and H in our sample.

* Islands of Capability (Stage Two). Our study suggests that most leading product innovators are at the islands of capability stage, including companies A, C, D, I, J, and K. These companies realize the potential of having a well-managed front end and have some of the required capabilities, but inconsistently. Missing are many elements of front-end process integration. Companies find it easier to improve the formality of this process than to address the subtle gaps in integration.

How can companies evolve from "awareness" to "islands of capability"? That depends on what the business" to unit has already achieved and what the business it needs already given its industry and what company. We it needs, given two broad approaches to achieving stagecompany. We identified two broad approaches to achieving stage two. First, those companies that have barely begun to understand the importance of the front end - for example, company H -should recognize that product development is a senior management responsibility Managers should carry out several structured activities, such as the diagnostic test. Second, those companies that recognize the importance of the front end - such as companies B and E - should formally and systematically conduct various front-end activities. Those activities include having an explicit product definition, estimating technology requirements early, and planning resources.

(Graph Omitted)

Captioned as: Figure 2

Integrated Capability (Stage Three). Front-end product development integration, the hallmark of stage three, is quite rare. We believe that most companies don't understand that this stage is significant in terms of required capabilities, and achieving it takes concerted effort. At the few companies with this degree of process integration -- companies F, G, and, to some extent, J - analysis and decisions have been both explicit and rigorous, and all front-end activities are managed as a single process. Stage three companies execute NPD projects better and faster than their competitors and are more likely to introduce a winning product. One can honestly say of these companies that "well begun is more than half done."

How can companies make a transition from "islands of capability" to "integrated capability"? Some stage two companies have much of the required formality but not necessarily the degree of integration to yield substantial benefits. Most stage two companies should focus on understanding the various dimensions of integration. Among our sample, we identified three clusters of companies that required somewhat different approaches to get to stage three. These three clusters represent generic front-end states and problems that many companies face.

While companies in the first cluster, A and K, have passed stage one, they still have a long way to go. They need to focus closely on senior management involvement in creating a product vision. Improvements in front-end formality and integration, while not easy, will be easier if the product development group can understand its purpose better.

Companies C and D make up the second cluster These companies will realize improvements from refinements in the front-end process. They need to make their front-end activities more explicit and, in particular, understand how to better manage their technology and resource requirements. Once they progress on these dimensions, they can focus more on cross-functional and integration problems.

The third cluster of companies, I and J, were the most advanced among the stage two companies. Front-end explicitness is not their main problem. Instead, their challenge is to work on cross-project issues and technological uncertainties. By having close ties among strategic planners and project personnel, they will understand the links among projects and anticipate matches or mismatches between future market needs and current technology and product plans. They need to establish closer connections between their R&D and product development groups so that they can anticipate overall technological progress and product-specific technological uncertainty.

(Chart Omitted)

Captioned as: Figure 3

Sustaining Stage Three. Clearly, reaching stage three is not easy; even those companies that have achieved it continue to require improvements. Changes in competition, technologies, tools, and organizational structures and relationships may need changes in at least some front-end practices.39

How can companies F and G improve? We found that these companies had minor deficiencies at their front ends (by using the diagnostic test in Table 2). Yet, the companies have potential for improvement. For example, knowing what to finalize and approve in product concept and definition, and what to keep flexible and open to change is important. Achieving a proper balance calls for more than just personal intuition and tacit understanding. Making explicit the connections between product requirements and internal

technology development remains an elusive capability. And maintaining continuous links among business-unit vision, product strategy, technology, and new products is an ongoing challenge. Managers at stage three companies need to evaluate and apply innovations such as developing carefully planned product architectures and platforms or adapting a front-end process - such as Cooper's - to deal with the dynamics of current technological, market, and organizational realities.40

Conclusion

Most companies have unnecessarily fuzzy front-end systems. The best way to integrate the front-end process is to use an overall systems perspective and thoroughly assess the current state of the front end. Fixing what appears to be broken requires the ability to see the interrelatedness of issues and the development of a coherent agenda.

We caution against oversimplification: not all companies should adopt the same front-end solution, and most will need to adopt more than one. For example, we found that companies used executive reviews in different ways with mixed success; some case study companies changed the role of the executive review group for different products. In general, company size, decision-making style, operating culture, and frequency of new product introduction are some factors that are critical to a preferred front-end solution. We discourage companies from importing a particular process or procedure that has worked well for others unless their contexts are clearly similar.41

Managing to become less fuzzy means integrating seemingly disparate but related strategic and operational activities, typically crossing functional boundaries. The solution must be balanced with the emerging realities of business and the environment. With proper diagnosis, consensus, and commitment, companies can enhance product development performance over the long term.

Appendix

We conducted our research between April 1994 and April 1995.a Of the sixteen companies invited to participate, eleven accepted. We chose companies based on whether they had a product-generation process and if they had NPD processes for one to eight years. Our final sample includes seven U.S. and four Japanese companies (all Fortune 500 companies or their equivalent in Japan) in various industries ranging from consumer packaged goods to electronics to industrial products (see Table A for more information on the specific industries). There are seven U.S., six Japanese, and two European business units (we interviewed managers at multiple business units at two companies). Business-unit size ranged from $300 million to $2.5 billion in annual sales, and 600 to 20,000 employees; company sizes ranged from $2 billion to $55 billion, and 20,000 to 300,000 employees. Further, we classified the companies as "active" or "neutral"; the active sites participated very closely in the research, and we had open access to them. At the neutral sites (companies B, E, G, and K), we had only one opportunity to get the data directly, i.e., only one visit or series of interviews. Naturally, the data from these companies are less detailed, although we obtained the essential information.

We adopted an exploratory and "action-oriented" approach because we iterated among data collection, analysis, and feedback. We conducted our research at three to four company sites, analyzed data, presented partial results to a group of participants at "dissemination" workshops, wrote reports for their review, revised our knowledge base and conceptual models, and went on to the next case sites. Thus, implicitly and by design, we

adopted the grounded theory approach.b

We spent more than 200 hours interviewing more than seventy-five managers. On average, for each active site, we spent between eight and forty hours interviewing from three to twenty-five managers; for each neutral site, we spent eight to fifteen hours interviewing up to eight managers. We held four days of dissemination workshops with more than twenty-five different managers from several research companies. We interviewed managers (ranging from functional managers to company president) from marketing, R&D, software development, engineering, manufacturing, field service, finance, accounting, strategic planning, product management, NPD process owners, and corporate/business-unit general management.

For most of the case sites, we used secondary data collection in an effort to understand the industry and company background. We then adapted our basic research and interview questions to match the company profile. Thus most of the interviews were largely unstructured to support our exploration of the relatively undefined nature of the front end of product development.

The basic unit of analysis for our cases was the process of the front end of new product development. However, due to access, confidentiality, time, and contrasts, we used several approaches to understand and evaluate the process. As Table A shows, our interviews took two different forms: (1) a study of individual NPD projects (multiple projects at each company) and (2) an in-depth study of business unit practices with regard to the process adopted for the front end of new product development. (We included multiple business units at two companies because these business units were in widely different markets or technologies, or because they were perceived to have distinctive front-end NPD practices.)

(Table Omitted)

Captioned as: Table A

a. In addition to the eleven cases directly involved in this research, we also draw on and cite examples from prior knowledge of several cases of new product development projects that the second author researched in 1989 to 1991. See:
S.R Rosenthal, Effective Product Design and Development (Homewood, Illinois: Business One Irwin, 1992).

b. B. Glaser and A. Strauss, The Discovery of Grounded Theory: Strategies for Qualitative Research (Chicago: Aldine Publishers, 1967); and KM. Eisenhardt, "Building Theory from Case Research," Academy of Management Review, volume 14, number 4, 1989, pp. 532-550.

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Reference:

1. The notion of the fuzzy front end and its importance was first introduced in:

P.G. Smith and D.G. Reinertsen, Developing Products in Half the Time (New York: Van Nostrand Reinhold, 1991). See also:

A. Khurana and S.R. Rosenthal, "Discovering the Shortcomings in the 'Front-End' of New Product Development: Findings from CrossIndustry Case Studies" (Boston: Boston University School of Management, Manufacturing Roundtable working paper, 1996); K.B. Clark and S.C. Wheelwright, Leading Product Development (New York: Free Press,1995);

S.R. Rosenthal, Effective Product Design and Development (Homewood, Illinois: Business One Irwin, 1992);

A.K. Gupta and D.L. Wilemon, "Accelerating the Development of Technology-Based New Products," California Management Review, volume 32, Winter 1990, pp. 24-44; and R.G. Cooper and EJ. Kleinschmidt, "New Products: What Separates Winners from Losers?," Journal of Product Innovation Management volume 4, September 1987, pp. 169-184.
2. See DA. Schon, The Reflective Practitioner: How Professionals Think in Action (New York: Basic Books, 1983), p. 266. 3. H.K. Bowen, KGB. Clark, C.A. Holloway, and S.C. Wheelwright, "Development Projects: The Engine of Renewal," Harvard Business Review, volume 72, September-October 1994, pp.110-120. For a business process view, see:

T. Davenport, Process Innovation: Reengineering Work through Information (Boston: Harvard Business School Press, 1993), chapter 11. 4. See Cooper and Kleinschmidt (1987); Gupta and Wilemon (1990); Smith and Reinertsen (1991);

Reference:

Rosenthal (1992); and Clark and Wheelwright (1995).

For a study on factors explaining "good" product definition, see: G. Bacon, S. Beckman, D. Mowery, and E. Wilson, "Managing Product Definition in High-Technology Industries: A Pilot Study," California Management Review, volume 36, Spring 1994, pp. 32-56. Of the key factors for NPD success identified by Bacon et al. and other researchers, several pertain to front-end issues: product-core competence fit, senior manager responsibility for NPD planning, clear understanding of user needs, explicit description of product concept and definition, careful planning, specifying contingency plans, and resource planning. For purposes of description and understanding, we divide Bacon et al.'s interpretation of product definition into product strategy, product definition, and project definition, primarily because these activities involve different analytical and implementation approaches. See, also: W.E. Souder, Managing New Product lnnovations (Lexington, Massachusetts: Lexington Books, 1987);

Booz Allen & Hamilton, "New Product Development in the 1980s" (New York: Booz Allen & Hamilton, 1982); and R. Rothwell, C. Freeman, A. Horsley, V.T.P Jervis, A.B. Robertson, and J. Townsend, "Sappho Updated -- Project Sappho Phase II," Research Policy, volume 3, number 3, 1974, pp. 258-291.
5. We first identifed a series of operational problems encountered in new product development and linked them to activities and practices at the front end. For that analysis, see: Khurana and Rosenthal (1996). 6. Bacon et al. (1994); and Gupta and Wilemon (1990).

While there has been limited research on the front end, researchers who study new product development often include some NPD success factors that pertain to the front end. See, for example: Smith and Reinertsen (1991); Rothwell et al. (1974); and
R.G. Cooper and EJ. Kleinschmidt, "Determinants of Timeliness in Product Development," Journal of Product Innovation Management, volume 11, November 1994, pp. 381-396.

7. Roberts and Fusfeld call a set of foundation-type activities "critical

Reference:

functions for enhanced innovation." They portray project-specific activities as a six-stage process starting with preproject activities. See: E.B. Roberts and A.R. Fusfeld, "Staffing the Innovative TechnologyBased Organization," Sloan Management Review, volume 22, Spring 1981, pp.19-34.

8. M. McGrath, Product Strategy for High-Technology Companies (Burr Ridge, Illinois: Irwin, 1995).

9. These are the top three levels of the strategic hierarchy presented by McGrath (1995). McGrath describes product strategy in a four-level hierarchy starting with strategic vision and then proceeding to product-platform strategy, product-line strategy, and, finally, individual projects.
10. Bacon et al. (1994). 11. McGrath (1995); and

R.G. Cooper and E.J. Kleinschmidt, "New Product Performance: Keys to Success, Profitability, and Cycle Time Reduction," Journal of Marketing Management, volume 11, September 1995, pp. 315-337. 12. McGrath (1995); Cooper and Kleinschmidt (1995);

D.G. Ancona and D.F. Caldwell, "Beyond Boundary Spanning: Managing External Dependence in Product Development Teams," Journal of High-Technology Management Research, volume 1, number 2, 1990, pp. 119-135; and

Reference:

D.G. Ancona and D.F. Caldwell, "Bridging the Boundary: External Process and Performance in Organizational Teams," Administrative Science Quarterly, volume 37, December 1992, pp. 634-665. 13. Selected research on these issues includes: K.B. Clark and T. Fujimoto, Product Development Performance (Boston: Harvard Business School Press,1991); and K. Imai, I. Nonaka, and H. Takeuchi, "Managing the New Product Development Process: How Japanese Companies Learn and Unlearn," in R. Hayes, K. Clark, and P. Lorenz, eds., The Uneasy Alliance: Managing the Productivity-Technology Dilemma (Boston: Harvard Business School Press, 1985), pp. 337-375; L. Dwyer and R. Mellor, "Organizational Environment, New Product Process Activities, and Project Outcomes," Journal of Product Innovation Management, volume 8, March 1991, pp. 39-48; and D. Dougherty, "Interpretive Barriers to Successful Product Innovations in Large Firms," Organization Science, volume 3, May 1992, pp.179-202. 14. Cooper and Kleinschmidt (1995). 15. The creation of product concepts is discussed in: C.M. Crawford, New Products Management, 3rd edition (Homewood, Illinois: Irwin, 1991).

Customer requirements should drive all product design and development, including the creation of product concepts. There is a growing body of information on how such requirements ought to be obtained and translated into product requirements. One familiar technique for translating customer

requirements into product attributes is quality function deployment (QFD). See:

J.R. Hauser and D. Clausing (1988), "The House of Quality," Harvard Business Review, volume 66, May-June 1988, pp. 63-73; and G.L. Urban and J.R. Hauser, Design and Marketing of New Products, 2nd edition (Englewood Cliffs, New Jersey: Prentice-Hall; 1993). 16. Bacon et al. (1994). 17. Bacon et al. (1994); and
K.M. Eisenhardt and B. Tabrizi, "Accelerating Adaptive Processes:

Reference:

Product Innovation in the Global Computer Industry," Administrative Science Quarterly, volume 40, March 1995, pp. 84-110. 18. R.H. Hayes, S.C. Wheelwright, and K.B. Clark, Dynamic Manufacturing (New York: Free Press, 1988); Dwyer and Mellor (1991); and

R. Cooper, "Third-Generation New Product Processes," Journal of Product Innovation Management, volume 11, January 1994, pp. 3-14. 19. See Rosenthal (1992); Smith and Reinertsen (1991); Cooper (1994); and

RG. Cooper, "Stage-Gate Systems: A New Tool for Managing New Products," Business Horizons, volume 33, May-June 1990, pp. 44-54. 20. Bacon et al. (1994); and Cooper and Kleinschmidt (1995). 21. For a description of phase review systems, see: Cooper (1990); and

Rosenthal (1992), chapter 2. See also: M.E. McGrath, M.T. Anthony, and A.R Shapiro, Product Development Success through Product and Cycle-Time Excellence (Boston: ButterworthHeinemann, 1992).
22. An alternative approach that is emerging in the best companies is based on platform planning and emphasizes that product opportunities are related to the development of product platforms. See: McGrath (1995); and

M.H. Meyer, P. Tertzakian, and J.M. Utterback, "Metrics for Managing Research and Development" (Cambridge: MIT Sloan School of Management, working paper 3817, 1995).

Reference:

23. S.C. Wheelwright and K.B. Clark, Revolutionizing Product Development (New York: Free Press, 1992).

Several product development researchers have raised the issue of roles, e.g., project managers (Wheelwright and Clark, 1992), and core team and executive reviews (McGrath et al., 1992). However, our interest is in looking at how these roles influence the front end of new product development and what challenges arise as a result of the interactions among these roles.

24. In some companies that do platform planning in a serious way, one can visualize the development of a platform concept or architecture also as a front-end deliverable. 25. Meyer et al. (1995). 26. Wheelwright and Clark (1992). 27. Ancona and Caldwell (1990); and Ancona and Caldwell (1992).

28. Clark and Fujimoto suggest that in such cases, there is often "little or no attention to integrating a clear sense of customer expectations into the work of the product development organization as a whole." See:

KB. Clark and T. Fujimoto, "The Power of Product Integrity," Harvard Business Review, volume 68, November-December 1990, pp.107-118. 29. Though

not all platforms or product lines can plan for multiple releases at frequent intervals, proactive planning of product releases a few years ahead is desirable. For example, Sony does not necessarily plan multiple releases but achieves the same objective by freezing the product design early on. It then begins work on the next product model concurrently to incorporate changes in customer needs or technology. See: Meyer et al. (1995); McGrath (1995); and

S. Sanderson-Walsh and M. Uzumeri, "Managing Product Families:

Reference:

The Case of the Sony Walkman," Research Policy, volume 24, September 1995, pp. 761-782; and

P.R. Nayak and J.P. Deschamps, Product Juggernauts (Boston: Harvard Business School Press, 1995). 30. See, for example:

RR Kamath and J.K. Liker, "A Second Look at Japanese Product Development," Harvard Business Review, volume 72, November-December 1994, pp. 154-170.

31. KA Howard, "Postponement of Packaging and Product Differentiation Lowers Logistics Costs," in A.K. Chakravarty, ed., Globalization of Technology, Manufacturing and Service Operations (New Orleans: Tulane University, Goldring Institute, A.B. Freeman School of Business, Proceedings of Symposium, 7-8 January 1994). 32. Apparently, such redundancy is at the heart of Toyota's development success. See:

Ward, J.K. Liker, J.J. Cristiano, and D.K. Sobek II, "The Second Toyota Paradox: How Delaying Decisions Can Make Better Cars Faster," Sloan ManagementReview, volume 36, Spring 1995, pp. 43-61. In the context of design, simultaneously working on multiple subsystem/component alternatives generally leads to a faster product development cycle. We suggest that the same is true for planned and anticipated redundancy in the face of technological or other risks. 33. Other interrelationships that have been mentioned in previous research, e.g., Bacon et al. (1994), and used at several case study sites include: the need for strategic alignment between product development efforts and overall business strategy, the direct links between product definition and project planning, the close association of project planning and staffing policies, and the need to modify the roles and responsibilities of key organizational members as a function of project complexity and size.

Reference:

34. P. Lawrence and J. Lorsch, Organizations and Environments (Homewood, Illinois: Irwin, 1969); and Clark and Fujimoto (1991).

35. D. Dougherty and E.H. Bowman, "The Effects of Organizational Downsizing on Product Innovation," California Management Review, volume 37, Summer 1995, pp. 28-44. 36. Ward et al. (1995); and

M. Iansiti, "Shooting the Rapids," California Management Review, volume 38, Fall 1995, pp. 1-22.

37. This notion of balance also reflects our agreement with an article on balancing instinctive and fully analytical decision making. See: A Langley, "Between 'Paralysis by Analysis' and 'Extinction by Instinct'," Sloan Management Review, volume 36, Spring 1995, pp. 63-76. 38. In the "pre-emergent" stage, a company has no formal front end, nor does it

perceive the need for one; none of the companies we studied fell into this category. This situation is common either in start-up companies in which a few principals make product development decisions informally, or in business units where structured product innovation is not yet the basis for competition. NPD activities for such organizations are tightly integrated, but often a few senior managers do this tacitly.

Reference:

39. See, for example:

S.L. GoldmanK. Preiss, Agile Competitors and Virtual Organizations: Strategies for Enriching the Customer (New York: Van Nostrand Reinhold, 1995). 40. See Meyer er al. (1995); McGrath (1995); and

Sanderson-Walsh and Uzumeri (1995). For a proposed new model of the stage-gate system, see: Cooper (1994).

41. A full description of why a company should adopt more than one front-end solution, and what these solutions might look like, is beyond our scope. While we do not yet have a full map of "compatible contexts," some of the contingencies we have discovered are: radicalness of product, maturity of industry, experience of the business unit with formal front-end processes, small or large firm, and entrepreneurial or conservative firm. We are currently writing a paper that more fully develops this perspective.

Author Affiliation:

Anil Khurana is assistant professor of operations management and Stephen R. Rosenthal is professor of operations management and director of the Manufacturing Roundtable at the School of Management, Boston University.

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